

METALS, MINDS AND MOBILITY

Integrating Scientific Data
with Archaeological Theory



EDITED BY XOSÉ-LOIS ARMADA,
MERCEDES MURILLO-BARROSO & MIKE CHARLTON

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Edited by

XOSÉ-LOIS ARMADA, MERCEDES MURILLO-BARROSO

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MIKE CHARLTON

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Front cover: Spearheads from Alcaíán deposit (Alcaíán lake, Seavia, Coristanco, NW Spain) (Museum of San Antón, A Coruña, Spain) (photo: ALBIMEH project); base image: Blue Marble: Next Generation, NASA Earth Observatory.
Back cover: A copper chisel from Sultana-Malu Rosu tell settlement (Romania) (photo: T. Ignat).

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Contributors

XOSÉ-LOIS ARMADA

Institute of Heritage Sciences (Incipit), Spanish National Research Council (CSIC), Santiago de Compostela, Spain.

DANIEL BERGER

Curt-Engelhorn-Center Archaeometry gGmbH, Mannheim, Germany.

PETER BRAY

Research Laboratory for Archaeology and the History of Art, University of Oxford, UK.

GERHARD BRÜGMANN

Curt-Engelhorn-Center Archaeometry gGmbH, Mannheim, Germany.

MIKE CHARLTON

UCL Institute of Archaeology, London, UK.

ADELINA DARIE

Bucharest Municipality Museum, Bucharest, Romania.

CAROLIN FRANK

Institute of Earth Sciences – Institute of Prehistory, Protohistory and Near-Eastern Archaeology, Heidelberg University, Germany.

MIGDONIA GEORGESCU

National History Museum of Romania, Romania.

LENA GRANDIN

Geoarchaeological laboratory, The Archaeologists, The Swedish History Museums, Sweden.

EVA HJÄRTHNER-HOLDAR

Geoarchaeological laboratory, The Archaeologists, The Swedish History Museums, Sweden.

MARK A. HUNT ORTIZ

Departamento de Prehistoria y Arqueología, Universidad de Sevilla, Spain.

TOBIAS L. KIENLIN

Institut für Ur- und Frühgeschichte, Universität zu Köln, Germany.

CATALIN LAZAR

National History Museum of Romania; University of Bucharest. ArchaeoScience#RO, Research Institute of the University of Bucharest (ICUB), University of Bucharest, Romania.

BORJA LEGARRA HERRERO

UCL Institute of Archaeology, London, UK.

JOHAN LING

Department of Historical Studies, Archaeology, University of Gothenburg, Sweden.

JANETA MARAHRENS

Curt-Engelhorn-Center Archaeometry gGmbH, Mannheim, Germany.

MARCOS MARTINÓN-TORRES

Department of Archaeology, University of Cambridge, UK.

LENE MELHEIM

Department of Archaeology, Museum of Cultural History, University of Oslo, Sweden.

IGNACIO MONTERO-RUIZ

Institute of History (IH), Spanish National Research Council (CSIC), Madrid, Spain.

MERCEDES MURILLO-BARROSO

Departamento de Prehistoria y Arqueología, Universidad de Granada, Spain.

BIANCA NESSEL

Institute of Earth Sciences – Institute of Prehistory, Protohistory and Near-Eastern Archaeology, Heidelberg University, Germany.

GHEORGHE NICULESCU

National History Museum of Romania, Romania.

ALICIA PEREA

Institute of History (IH), Spanish National Research Council (CSIC), Madrid (retired); Independent Researcher, Au Project, Spain.

ERNST PERNICKA

Institute of Earth Sciences – Institute of Prehistory, Protohistory and Near-Eastern Archaeology, Heidelberg University; Curt-Engelhorn-Center Archaeometry gGmbH, Mannheim, Germany.

NÚRIA RAFEL FONTANALS

Departament Història, Universitat de Lleida, Spain.

MICHAEL ROWLANDS

UCL Anthropology, London, UK.

SUSAN SHERRATT

Department of Archaeology, University of Sheffield, UK.

IGNACIO SORIANO

Departament de Prehistòria, Universitat Autònoma de Barcelona, Spain.

ZOFIA A. STOS-GALE

Department of Historical Studies, Archaeology, University of Gothenburg, Sweden.

Chapter 1

Metals, minds and mobility: An introduction

Xosé-Lois Armada, Mercedes Murillo-Barroso and Mike Charlton

The circulation and supply of metals have traditionally been considered a key issue in the analysis of social dynamics of late prehistory. However surprising it might be, there are not many books devoted to discussing the phenomenon with a broad perspective in geographical and chronological terms. Even in classic works on exchange and trade in European prehistory (e.g. Scarre and Healy 1993), metals have smaller incidence than one would expect. Although determination of a metal object's provenance has been one of the main motivations of archaeometallurgical research almost since its inception (Pernicka 2014; Pollard *et al.* 2014), the impact of these studies in the general archaeological debate and reconstructions of the past has been limited. The low levels of communication between 'archaeologists' and 'archaeometallurgists' is, in Pearce's opinion (2016), one of the reasons for this divorce.

Metals Make the World Go Round, a book edited by Pare (2000) that emerged from a congress held in Birmingham in 1997, may be the best-known collective work on the circulation of metals in the European prehistory. Its 18 contributions reflect the state of the art at the turn of the millennium. In particular, the book shows that approaches based on the typology and quantification of metals can be very clarifying if they are applied in an appropriate way. However, the use of analytical information is rather scarce, with only two chapters focused on compositional data and lead isotope analysis only present in the two contributions by the Oxford team.

The present volume emerges from a session held at the 21st Annual Meeting of the European Association of Archaeologists in Glasgow, Scotland, on September 2015, which aimed to integrate archaeometallurgical data with archaeological theory to address questions about past mechanisms of exchange, mobility and social

complexity (session SA14, entitled 'New approaches to metals trade and people mobility: Integrating scientific data with archaeological theory').

This session was designed in a very specific context: the three of us had obtained a Marie Curie Fellowship funded by the European Commission at the UCL Institute of Archaeology (working at the very same office); our three projects dealt with metallurgy (copper, bronze or iron); all of them concerned with the circulation of metals in one or another way; all were supervised by the same scientist in charge (Marcos Martín-Torres); and the three of us were using a range of archaeometric techniques despite of asking different questions and being derived from different theoretical approaches. This synergistic context gave us the opportunity to discuss the role of scientific techniques and the contribution of archaeometry to solve (or at least to add some light) on different archaeological and historical questions. That materialised into the organisation of the aforementioned session at the EAA conference in Glasgow.

Several longstanding and new questions arose at that session: the circulation and provenance of metals including tin and iron; the transmission of metallurgical knowledge; the characterisation of different models of exchange and material circulation and the application of new analytical techniques in the investigation of the archaeological record. The success of the session and the interesting discussions that followed encouraged us to go a step further by consolidating them into this edited volume. However, it bears mention that the book's contents differ from the original session, as some participants were unable to contribute to the volume while a number of chapters have been written under invitation in order to have a broader coverage of topics.

The main aim of the book is to build a bridge between archaeological science and theory by bringing together

theoretical and analytical approaches that, in our view, should be deployed together towards a common goal: the understanding of past societies. The circulation of metal has long been viewed as a catalyst for social, economic and population changes in Europe and these theories are rooted in the distribution of metal objects across time and space. In this sense, new techniques and perspectives derived from archaeological science can shed new light on the understanding of the movement of people, materials, and technological knowledge. In recent years these science-based approaches have situated mobility at the forefront of the archaeological debate (*e.g.* Kristiansen 2014), but surprisingly no overview of current perspectives on the topic exist at this moment. Advances in the characterisation of metals and metallurgical residues (including bulk elemental composition by XRF/pXRF, X-ray microanalysis, PIXE, ICP-OES and LIBS; trace elemental by NAA and ICP-MS and isotopic analysis by TIMS and MC-ICP-MS) combined with more sophisticated approaches to data analysis add greater resolution to provenance studies. Though offering better pictures of artefact source, the explanation of artefact distribution across geographic space requires the use of theoretically informed models and solid archaeological evidence to discern differences between the circulation of raw materials, ingots, objects, craftspeople and populations, plus the impact that this circulation could have had in social structures and *vice versa*. Full characterisation of metals circulation is essential to understanding its impact on social practices and the emergence of complexity and linguistic as well as cultural transfers of interacting peoples. In any case, the book does not pretend to be a systematic overview of the different theoretical approaches and methodological developments, but exemplify some of the hottest topics and discuss some intriguing possibilities of integrating scientific data and archaeological theory. Nor have we intended to be exhaustive in the chronological and geographic coverage, although the European and Mediterranean Recent Prehistory are our main focus, with occasional incursions in other areas.

Bringing together some of the world's leading experts in the archaeological sciences and the archaeology of Europe and the Mediterranean, the book addresses topics that include: 1) invention, innovation and transmission of metallurgical knowledge; 2) science-based models of exchange; 3) characterisation and discrimination of different modes of material circulation; and 4) the impact of metals on social complexity. Alongside the introductory and concluding chapters, a total of ten individual chapters are organised in three main sections dealing with key debates in archaeology. Papers in the first section focus on the transmission of metallurgical technologies, knowledge, and ideas; papers in the second section deal with prestige economies and exchange; while papers in the third section emphasise the circulation of metal as commodities.

This structure approaches the different perspectives that metallurgy and metals may have in society: as knowledge and technology, as prestige items, and as commodities. It should be emphasised, however, that these mechanisms of exchange and circulation do not constitute immobile or exclusive realities, but often worked as simultaneous processes within the same networks.

Metals and mobility in archaeological research: A diachronic view

Metals and metallurgy have been a central element in the development of models of historical explanation of humanity since the 18th century. The configuration of Europe as the economic center of the world generated a gradual transformation in European thought that favoured a stage-like evolutionary vision of the past and of History. The revolutions and scientific advances of the 16th and 17th centuries, their application to the development of technology, and the perception of the ways of life of the technologically less advanced peoples of the colonies generated a growing faith in *Progress* and in technological development as a motor of social advance; ideas formulated by the philosophers of the Enlightenment. It is precisely in this context that the scheme of the Three Ages – Stone, Bronze and Iron – begins to be generalised, since Mahudel firstly proposed it in 1734 in Paris recovering the classical sources of Titus Lucretius Carus (Trigger 2006, 104–05). However, it was the work of Ch. J. Thomsen and other Danish and Swedish scholars that popularised this scheme from 1835 onwards (Rowley-Conwy 2004; 2007). An evolutionary approach to the first development of humanity is thus generalised, with the emergence and advancement of technology and especially metallurgy as the major trajectory.

Although first composition analyses of metals by gravimetry date back to the late 18th century (Pollard 2015), it is in the late 19th and early 20th centuries when the interest in determining the elemental composition of archaeological metals notably increases (Caley 1967; Müller and Pernicka 2009, 296–97; Liu *et al.* 2015). The objectives of these analyses used to be to investigate the casting technology or the sequence of use of the different metals and alloys (*e.g.* Marsille 1913, 24–26, 39–51; Siret 1913, 318–86, 461–66; Castillo 1927, 95–96). The issue of metals provenance was also frequently raised, although it faced the analytical limitations for determining trace element compositions (Pernicka 2014, 240).

At the end of the 19th century, the rise of nationalistic movements in Europe added a new factor to the study of the history of humanity: ethnicity. In this context, a reciprocal relationship between the growth of nationalism and that of archaeology itself is established (Díaz-Andreu 2007). On the one hand, advances in archaeology contributed to different

peoples and ethnic groups a way to better know their origins and identity, and on the other hand this nationalist perspective places emphasis on the study of artefacts with the aim of differentiating the material cultures of each group, equating in the archaeological record material culture and ethnicity or society. As Trigger (2006, 218) pointed out, the loss of faith in progress along with the growing idea that human behaviour was biologically determined led to growing skepticism in human creativity, understanding that the condition of human beings was rather static, posing resistance, by nature, to any inventiveness or change that would imply an alteration in their way of life, their technology or their *savoir-faire*. This fostered the success of diffusionist theories since it was considered improbable that inventions (especially if they were associated with certain technological development and complexity) were given independently in several places and explanations of any cultural change would almost systematically resorted to theories of diffusion, migration or transmission of ideas from one people to another. The irradiating center from which the technological innovations were spread was located in the Near East: it would be Montelius' *Ex Oriente Lux*.

This has been the case of the explanation of the origins of metallurgy in Europe. Vere Gordon Childe – whose ideas have been greatly influential in archaeological literature – placed metallurgical technology at the forefront of social change. He was one of the first authors to propose the origins of metallurgy and the first metallurgical specialists as major drives behind the rise of social division of labour, social elites and stratified societies (Childe 1956; see also Kuijpers 2018, 1–4). His intellectual prestige was key to enhancing the idea of the diffusion of metallurgy from the Near East to the rest of Europe (Childe 1930; 1939). Pere Bosch Gimpera, one of the most prominent Spanish archaeologist at the time and another good representative of this approach, stated in his well-known synthesis of 1932 that ‘metals trade provides the key to the explanation of everything’ when analysing the external relations of the Iberian Peninsula, although recognising immediately the complexity of the issue (Bosch Gimpera 2003 [1932], 241).

The development of emission spectrometry in the 1930s and its greater ability to determine trace elements gave rise, in the same decade, to the first systematic analysis programs of archaeological metals in Germany and England, in the latter case promoted by Childe himself (Pollard *et al.* 2007, 7–8, 64; Pernicka 2014, 240–47).

The idea of the origin of metallurgy in Europe through a diffusion process originating in the Near East was not questioned until the second half of the 20th century, with Renfrew's famous isochrone map (Renfrew 1967; 1970) showing the earlier chronology of the Western megalithic phenomenon, and proposing the independent emergence of metallurgy in Western Europe (*contra* Wertime 1973). This change of paradigm was motivated by one of the most

important developments in archaeological sciences in the 20th century: radiocarbon dating (Renfrew 1973).

The spread of the new *processual* paradigm (the American *New Archaeology*) since the late 1950s (Trigger 2006; Criado Boado 2012, 62–78), in which the consolidation of Renfrew's proposals played a crucial role, fostered the development of archaeological sciences in their interest of making use of sophisticated quantitative techniques and ideas from other disciplines. Their disappointment with the descriptive tendency of the traditional archaeology led them to look into ‘real science’, where ‘proper scientists’ used quantitative data to contrast hypothesis and make generalisations. That was the model that the ‘New Archaeologists’ brought into archaeology: hypothetic-deductive *vs.* inductive reasoning and a quantitative contrasting in order to generate explicit models of historical processes. This new paradigm in the context of rapid scientific and technological advances of the post-war period was the breeding ground for the emergence and consolidation of archaeological sciences, which had a decisive impact on archaeometallurgical studies.

An example of its consolidation would be the launch of the journal *Archaeometry* as the *Bulletin of the Research Laboratory for Archaeology and the History of Art* of the University of Oxford in 1958; one of its objectives being ‘the closer marrying of science and archaeology’ (Hall 1958, 1). The pioneering works of R. Tylecote and B. Rothenberg in Britain as well as H. G. Bachmann in Germany combined field work and scientific analyses of archaeometallurgical debris in order to identify the different steps of metallurgical production (*chaîne opératoires*). Likewise, the first systematic large-scale science-based approaches to archaeometallurgy were developed by the Studien zu den Anfängen der Metallurgie (SAM) project in Germany with the objective of provenancing metals across Europe on the basis of their elemental compositional pattern (Junghans *et al.* 1960; 1968; 1974). Still influenced by popularised culture history accounts, *fossil guides* were substituted by chemical groups to trace centres of production and geographical distribution of metal objects, but now based on their chemical composition rather than on their typological form (Krause and Pernicka 1996; Montero-Ruiz 2002, 58; Pollard *et al.* 2007, 64–66; Pernicka 2014, 242–47).

However, it was lead isotope analysis, a technique implemented in archaeology from geochemistry since the 1970s, that shook provenance studies up thanks to the input of N. Gale and S. Stos-Gale at the Isotrache Laboratory in the University of Oxford with the development of the OXALID database (*e.g.* Gale *et al.* 1980; Gale and Stos-Gale 1982; Pernicka *et al.* 1997; Stos-Gale *et al.* 1997; Stos-Gale and Gale 2009). For the first time, and especially in combination with trace elements pattern, it was possible to link metal objects to ore deposits. After years of intense controversy

and methodological refinement (*e.g.* Budd *et al.* 1993; Baxter *et al.* 2000; Pollard 2009; Gale 2009; Albarède *et al.* 2012; Baron *et al.* 2014), lead isotope analysis has become the primary tool for the study of non-ferrous metal circulation.

This slow but progressive generalisation of lead isotope studies over 30 years, due to its own complexity and the need to have a good characterisation of geological resources, explains, in part, its small impact on the theoretical paradigms that emerged from the late 1970s, such as those based on prestige economies (Frankenstein 1994; 1997), on the application of the World Systems Theory and the centre–periphery models (Rowlands 1987; Sherratt 1993; 1994) or more recently in the postcolonial theory (Gosden 2004; van Dommelen 2005). Although a significant role is given to the exchange and trade of metals, references to isotopic studies are almost absent in the most representative publications of these theoretical paradigms, with exceptions (*e.g.* Sherratt and Sherratt 1991).

It should be noted, however, that in the last three decades the Mediterranean has been a key area in the debate on metals trade and the application of science-based approaches to its study, as shown by some pioneering works in areas such as Cyprus or Sardinia (Knapp and Cherry 1994; Knapp 2000; Begemann *et al.* 2001; Gale 2001; Lo Schiavo *et al.* 2009). The well-known Uluburun shipwreck (Uluburun, Turkey) (Pulak 2001) would constitute an example of the intensity of metals trade as well as many other objects from different provenances. Isotope analysis also adds strong support to the hypothesis that Cyprus was one of the most significant copper producers in the Mediterranean, its metal reaching the Central and Western Mediterranean in the form of oxhide ingots (*e.g.* Gale 1999; Kassianidou 2001; Philip *et al.* 2003; Stos-Gale and Gale 2010; Yahalom-Mack *et al.* 2014). Similarly, Phoenician expansion to the West and the role of their colonisation has been another hot topic to which provenance studies is also contributing, since metals (and especially silver and tin) have traditionally been claimed as an incentive in their Mediterranean expansion, although this hypothesis remains a subject of intense controversy (*e.g.* Frankenstein 1997; Muhly 1998; Aubet 2001; Armada *et al.* 2008, 466–68; Murillo-Barroso *et al.* 2016).

Although the so-called postcolonial archaeology has played an important role in the study of the Mediterranean in the last two decades (Gosden 2004; van Dommelen 2005; Fernández Martínez 2006, 163–207), in general the emergence of post-processual archaeology gave rise to a notable – and surely healthy – theoretical fragmentation in the discipline (Fernández Martínez 2006; Criado Boado 2012; Hodder 2012; Harris and Cipolla 2017). In this context, some archaeologists have shown great receptivity to archaeological sciences, while other traditions have been little interested – or even hostile – to their contributions. However, the general trend has been a growing understanding between archaeological theory and archaeological sciences

(Martín-Torres and Killick 2015), which obviously enhances the debates that are the subject of this book.

Emerging trends and perspectives

In the past recent years we have witnessed a clear resurgence of the study of mobility. This trend has its roots in at least two phenomena. On the one hand, the reaction to the *autochthonist* vision of processual archaeology and the logical evolution of the theoretical approaches of the last decades (prestige goods economies, centre-periphery models, postcolonial archaeology...). On the other hand, the advances in archaeological science, particularly in areas such as the aDNA (Ion 2017) or isotopic studies (Nord and Billström 2018). The wildcard concept used in many of these new approaches is that of *interaction*.

The book by Kristiansen and Larsson (2005) *The Rise of Bronze Age Society* is a good example of these new trends, highlighting the transformative capacity of esoteric knowledge and long-distance contacts. The authors pose the need for ‘a new theoretical and interpretative framework for understanding and explaining interaction’ (Kristiansen and Larsson 2005, 30), in which they grant particular importance to the re-contextualisation of symbols and the identification of Bronze Age institutions through material culture. In their words, ‘an intercontextual, interpretative strategy implies, first, to trace central symbols throughout all the contexts where they appear, and second, to interpret and reconstruct the meaning and institutional structure of this new intercontextual evidence in time and space’ (Kristiansen and Larsson 2005, 12). Although the application of this model to the interaction between the Bronze Age societies of the Near East, the Mediterranean, and Europe raises important criticisms (*e.g.* Harding 2006; Kienlin this volume), the idea of a strong interconnection in this period of European prehistory also has remarkable support, especially among the archaeologists of Nordic Europe. In this line, we should mention the political economy model of Earle *et al.* (2015), highlighting the importance of regional comparative advantages in long-distance trade and resulting bottlenecks; or Vandkilde’s (2016) definition of Bronze Age as a type of pre-modern globalisation, which would be motivated by the scarcity of tin sources and their concentration in very specific areas far from the early *foci* of urbanisation and irrigation agriculture. Within this research tradition significant studies on metallurgical technology and metals circulation have also appeared in recent years (*e.g.* Ling *et al.* 2014; Melheim 2015; Melheim *et al.* this volume).

In more recent works, Kristiansen has coined the concept of ‘Third Science Revolution’, stating that advances in archaeological sciences, the presence of large funding sources like the European Research Council (ERC), and *big data* are motivating a paradigm shift in the discipline. In his opinion, ‘interactions of all things movable (humans,

animals, objects, raw materials, etc.) and the networks they move through' will be 'the main research theme during the next two decades' (Kristiansen 2014, 20). In his comment to this work, González-Ruibal (2014) warned about the dangers of building a past modeled after our globalised and interconnected present – 'my impression is that we are finding too much movement in the past', in his own words (González-Ruibal 2014, 42). No less relevant is his claim for other archaeological traditions less linked to the great sources of funding, technological development, and the benefits of globalisation.

The contribution of European funding (mainly ERC projects and Marie Skłodowska-Curie Actions) to the research of the issues that are subject of this book is unquestionable. Among the projects on archaeology funded by the ERC program, with budgets that usually range between 1 and 2.5 million Euros, those dealing with large-scale interactions, hominids and domestication of plants and animals are frequent. And on one way or another they involve the circulation of people and ideas and they make an intensive use of archaeological science. In the specific field of metallurgy ERC has funded two Advanced Grant projects, both of them contributing to this book (chapters by B. Nessel *et al.* and P. Bray). The first one, led by Ernst Pernicka (Heidelberg) and awarded in the 2012 call, is titled *Tin Isotopes and the Sources of Bronze Age Tin in the Old World* (BRONZEAGETIN).¹ With a multidisciplinary perspective, in which the use of tin isotopes stands out, the project has advanced in this complex question, although facing two main problems: the large isotopic overlap between some of the main sources and the isotopic fractionation under certain conditions during the smelting process (Berger *et al.* 2017; 2018; Nessel *et al.* this volume; see also Martínón-Torres this volume). Other contributions of recent years, sometimes in collaboration with this project, are also expanding our knowledge of ancient tin (e.g. Wang *et al.* 2016; Figueiredo *et al.* 2018). The second project, granted in the 2014 call, is entitled *Flow of ancient metals across Eurasia* (FLAME) and is led by Mark Pollard (Oxford).² To a large extent, the project is based on previous contributions by P. Bray and M. Pollard, who emphasise the importance of metal recycling and make a proposal for classifying metals in terms of the presence/absence of four elements (As, Sb, Ag and Ni) (Bray and Pollard 2012; Bray 2016). Although the latter has been criticised (Pernicka *et al.* 2016, 37–8), when used correctly it has proved useful for analysing changes in the supply and type of metal used on a macro-regional scale. Other highlights of this project are its emphasis on the use of legacy data, the collection of datasets, and the wide geographic coverage that includes all of Eurasia with a specific focus on China (e.g. Liu *et al.* 2015; Jin *et al.* 2017; Hsu *et al.* 2018). In the field of European funding, we must also mention the network *Forging identities: The mobility of culture in Bronze Age Europe*. This initiative was funded by the Marie Curie

– Networks for Initial Training program (FP7-People-2007-1-1-ITN) between 2009 and 2012 and coordinated by Aarhus University, in whose framework metallurgical research has also been developed (e.g. Kuijpers 2018).³

In his concluding chapter to this volume, Martínón-Torres considers the cycle that innovations tend to follow in archaeological sciences. The emergence of a method or technique (radiocarbon, lead isotope analysis, aDNA, etc.) is often accompanied by optimism and high expectations, which subsequently result in a stage of criticism, debate and methodological refinement. Finally, the innovation is consolidated and becomes part of the daily practice of the discipline. Provenance studies using lead isotopes are already in this third stage, which currently have a considerable amount of data, both archaeological and geological. This last aspect is crucial, since it is the isotopic characterisation of the mineralisations that allows linking the metal to a specific ore source (and also discarding it). The works by Stos-Gale and Gale (2009) and Ling *et al.* (2014) contain a synthesis of information available for the different mining areas of Europe and the Mediterranean, which in the latter years has witnessed significant increase with data from areas such as the Iberian Peninsula (Montero-Ruiz in press) and the Alps (Artioli *et al.* 2016; Pernicka *et al.* 2016). In conjunction with the isotopic information, the archaeological study of the mines (O'Brien 2015) and the studies of paleopollution by mining-metallurgical activities combining geochemistry and palynology (Meharg *et al.* 2012; Martínez-Cortizas *et al.* 2016; Mighall *et al.* 2017), are helping to construct a detailed map of metallurgical resource areas and a chronology of their exploitation.

The consolidation of lead isotopes has been parallel to the development of other techniques and methods to determine the origins of metals. We have already referred to tin isotopes and their role in the BRONZEAGETIN project (Nessel *et al.* this volume). Some recent works also explore the potential of other isotopes such as silver (Ag) and copper (Cu), sometimes in combination, to address issues of technology and provenance (Desautly *et al.* 2011; Powell *et al.* 2017). The progressive implantation of laser ablation (LA-MC-ICP-MS) for the determination of lead isotopes and trace elements should also be mentioned, which is allowing obtaining good results in solid samples and singular objects in which sample extraction is usually problematic, as in the case of gold artefacts (Standish *et al.* 2013; Dussubieux *et al.* 2016; Nocete *et al.* 2018). This adds new possibilities for the study of a usually difficult issue such as gold provenance (Pernicka 2014, 260–61), in whose determination other procedures have been used, such as the microchemical characterisation of archaeological artefacts and natural gold (Chapman *et al.* 2006).

Along with the development of techniques and analytical strategies, another expanding area of research is the statistical treatment of data (e.g. Charlton *et al.* 2012;

Charlton 2015; Hsu *et al.* 2018; Radivojević and Grujić 2018). Such techniques have a long history of use for the analysis of ceramic chemistry, especially that determined by NAA at large research facilities with access to advanced computers, quantitative cultures, and a tradition of coding. The power of modern personal computers and availability of sophisticated statistical software packages like *R* make such approaches have served to revolutionise both access and awareness of such approaches to researchers of all kinds, archaeometallurgists included. The rapid growth of archaeological information will make increasingly necessary not only the use of statistical methods but also the creation of information systems that allow it to be properly managed. In this context it is also worth mentioning the importance of the *grey literature* and, in particular, of the excavation reports generated by commercial archaeology, whose revision is essential to the production of new syntheses (Bradley *et al.* 2016). No less relevant, in the field of metallurgy, is the information generated in the UK by the Portable Antiquities Scheme (PAS) (*e.g.* Murgia *et al.* 2014), a model whose advantages and disadvantages cannot be discussed here.

The inception of metallurgy is also one of the debates that have strongly re-emerged in recent years (Höppner *et al.* 2005; Roberts 2008; 2009; 2014; Roberts *et al.* 2009; Amzallag 2009; Radivojević *et al.* 2010; Thorthon *et al.* 2010; Murillo-Barroso and Montero-Ruiz 2012; Pearce 2014; Montero-Ruiz and Murillo-Barroso 2016). Even though American metallurgy almost guarantees its independent invention, there is not the same consensus for the situation in Eurasia. The idea that in Eurasia metallurgical technological knowledge must necessarily have been transmitted from person to person with an origin in the Near East is once again on the table, underlying a perspective of Western Europe societies with little capacity for experimentation and innovation. However, this perspective is not restricted to migration arguments, but also seeks to discern the means by which metallurgy was introduced to certain areas: through population movement (*diffusion*), through ideas and knowledge exchange (*acculturation*); or conversely, the origins of metallurgy as an independent invention.

The unique origin hypothesis is based on the idea that the inception of metallurgy constitutes a qualitative technological leap with respect to pre-existing technologies given its apparent complexity. It is assumed (more than explained) that metallurgical knowledge and skill ‘would have to have been learnt in one place and applied elsewhere. This could therefore apparently only occur through either the movement of individuals or groups possessing the smelting skills’ (Roberts 2014, 431). From other approaches, the appearance of metallurgy is also granted an especially different nature from other materials technologies, in this case defining it as a highly ritualised practice whose knowledge would have had a highly secret character only accessible to certain sectors of the population (*e.g.* Budd and Taylor

1995; Kienlin 2014). Such could be the case of the Italian Northeast, where the metallurgical contexts are located in rock shelters far from the settlements. Occasionally burials have also been documented in these shelters, so it has been suggested that funerary and metallurgical practices could be based on a secret and restricted knowledge that would only be revealed in certain areas far from domestic contexts (Dolfini 2014). While it is true that ethnographic studies show a ritual component in certain metallurgical practices as well (see *e.g.* Schmidt 1997 for iron metallurgy in Africa), it must be specific case studies that demonstrate (rather than assume) this restricted and secret nature, or highly complex metallurgical practices, or if on the contrary metallurgy was being developed collectively and communally within the framework of the relations typical to kinship societies (*e.g.* Murillo-Barroso *et al.* 2017; Del Pino *et al.* 2018). Therefore, not only the study of the technology itself, but especially the context in which it is developed, is crucial to understanding the social and the economic roles of metallurgy (Figure 1.1/Colour Figure 1.1).

As well as neo-diffusionism, neo-evolutionism seems to have re-emerged in the second half of the 20th century, perhaps influenced to a certain extent by the neo-evolutionist trends of North American anthropology. In the case of archaeometallurgy, this tendency could perhaps be reflected in Strahm’s (1994) proposal of metallurgical steps (updated in Strahm and Hauptmann 2009). This scheme proposes that the development of metallurgy followed a series of phases: 1) A *preliminary stage* of the usage of coloured stones (malachite, azurite, turquoise, variscite); 2) An *initial phase* of the first metallurgy using native copper; 3) The *innovation phase* for early metallurgy consisting of smelting oxide ores in simple vessels; 4) The *consolidation or developmental phase* when increasingly sulfide-rich ores and fahlore are smelted; and 5) The *industrial phase* with an intensive metallurgy. However, the extrapolation of this scheme to every region in the Old World is also being discussed with regional studies. Not all phases are identified in all regions (Rovira and Montero-Ruiz 2013) and the inception of metallurgy seems to have been a ‘polymetallic’ one in others (Radivojević *et al.* 2013).

Another subject whose study has been revitalised in recent years is that of the circulation of metal in Atlantic Europe (Figure 1.2/Colour Figure 1.2). Research on prehistoric contacts in this geographical area has a long tradition and gave rise, already in the decade of 1940s, to the emergence of the concept of *Atlantic Bronze Age* (Moore and Armada 2011, 10). The abundance of metal hoards and the relative invisibility of other aspects of the archaeological record explain the survival of an idealised image in which the role of the elites and the intensity of metals exchange stand out. The progressive increase of information on habitation and funerary contexts is allowing researchers to qualify this vision (Armada 2013). Along with the recent publication of important assemblages such



Figure 1.1 Blowing pipes and characteristic small, viscous slag fragments of early metallurgy from Las Pilas (Almería, Spain)



Figure 1.2 Spearheads from Alcaían deposit (Alcaían lake, Seavia, Coristanco, NW Spain) (Museum of San Antón, A Coruña, Spain) (photo: ALBIMEH project)

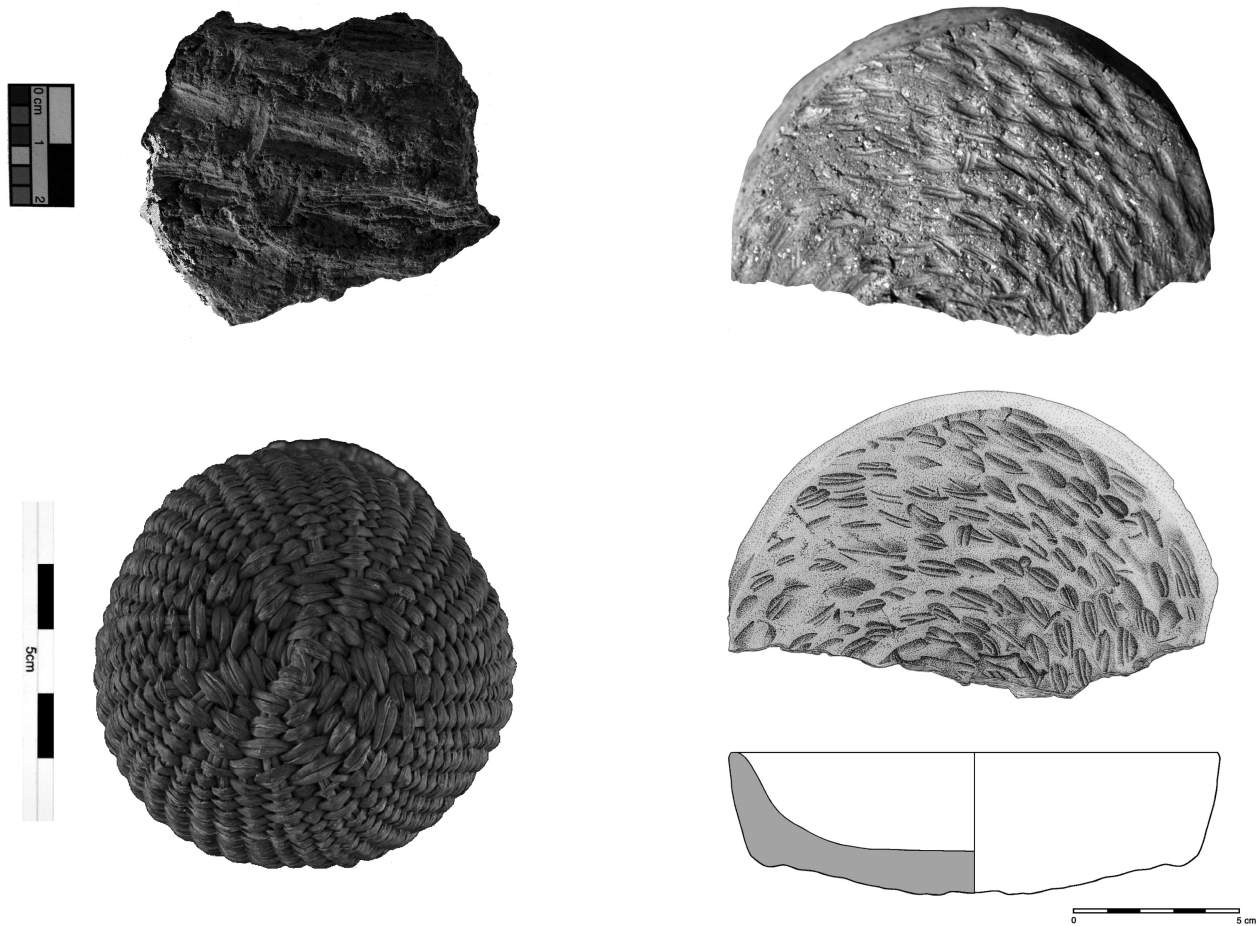


Figure 1.3 An example of cross-technology where basketry, pottery and metallurgy materialise common technical knowledge and skills. Top left: A crucible fragment from Las Pilas (Almería, Spain) showing plain-weave basketry imprints left by an *esparto* basket used to mould the vessel. This technique is commonly used in domestic pottery. Right: An example of a domestic bowl moulded following the same technique from Campos (Almería Spain). Bottom left: An example of a Neolithic basket from Cueva de los Murciélagos (Granada, Spain) (Murillo-Barroso *et al.* 2017, fig. 7)

as those of Boughton Malherbe (Kent), Salcombe (Devon) or Langdon Bay (Kent) (Needham *et al.* 2013; Wang *et al.* 2016; Adams 2017), the work by Ling *et al.* (2014) on metals provenance in the Scandinavian Bronze Age has been a significant input in the revitalisation of the debate. These authors trace the origin of a significant part of the copper used in the Scandinavian metallurgy of this period to the Iberian Peninsula, proposing a seaway for its arrival. In this context, one of the burning questions is to determine whether there was a directionality in the long-distance flows with metal moving through relatively rapid and well organised channels (Ling *et al.* 2014), or whether the circulation was slower, from hand to hand, less directional and through successive phases of recycling (Bray and Pollard 2012). In our view, detailed studies at a regional level are needed, with a comparative and standardised methodology (Armada and Martín-Torres 2016), to obtain a fine-grained perspective on the circulation of metals in the Atlantic area and its impact on local communities. In the case of the British Isles, for

instance, the arrival of continental metal during the Late Bronze Age has been proposed for decades, coinciding in time with the abandonment of exploitation of local copper mines at *c.* 1400 BC (Northover 1982; Timberlake and Marshall 2013; O'Brien 2015, 138–55; Timberlake 2017, 724). However, the work by Rohl and Needham (1998, 107–09) based on elemental and isotopic analyses, proposed Alderley Edge (Cheshire Basin) as a possible source for part of the copper and lead circulating during the phase Ewart Park (*c.* 1000–800 BC). Ongoing studies point to same conclusion, which, without questioning the import of continental metal, indicates the necessity of regional studies to obtain more accurate and better resolved images.

Lastly, and without any claim to covering the complexity of the current theoretical and methodological debate exhaustively in these pages, reference should be made to the healthy cross-technological and holistic approach that characterises much of the current research (Figure 1.3/Colour Figure 1.3). As Martín-Torres (this volume) points out,

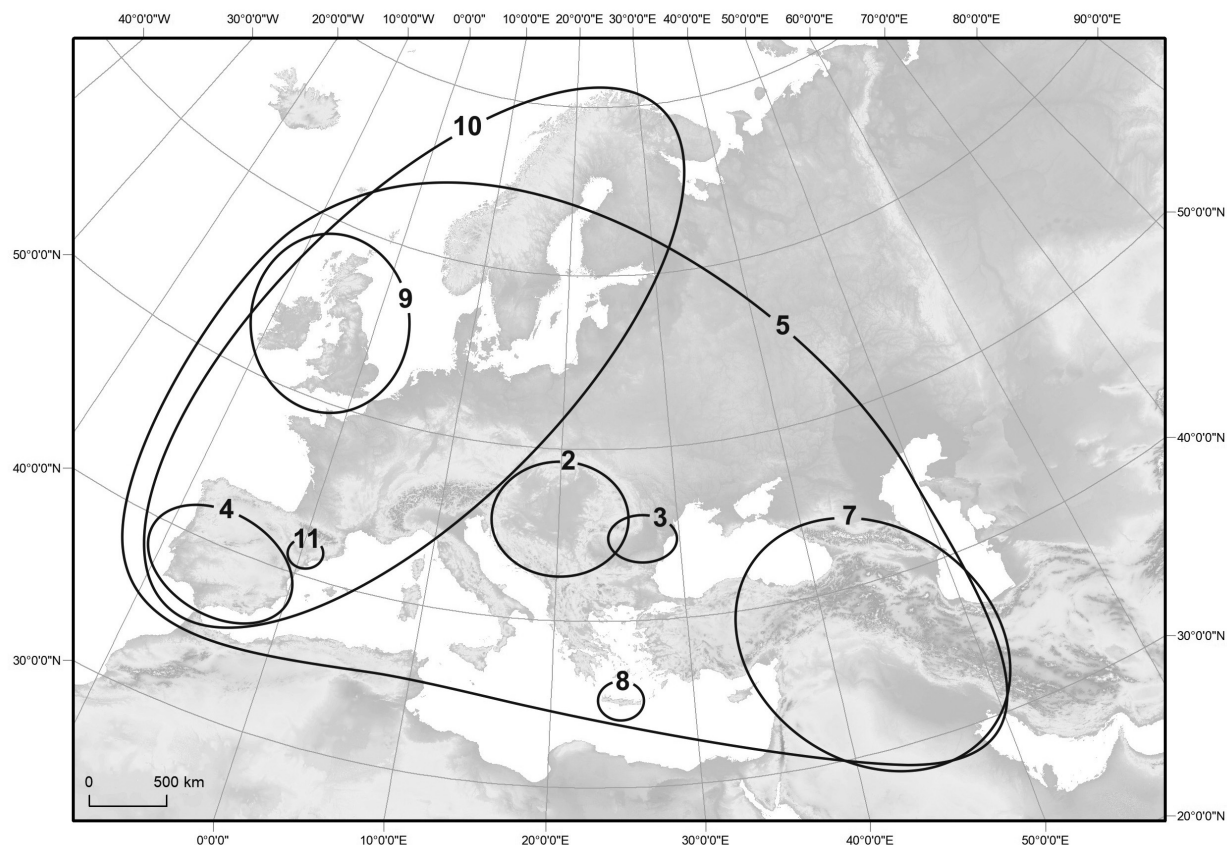


Figure 1.4 Geographic focus of papers in this volume (chapter 4 also deals with pre-Columbian gold) (map: Anxo R. Paz; cartographic base: GTOPO30, by USGS)

there is a growing tendency to integrate archaeometallurgy into the broader archaeological discourse. Studies which tend to jointly address the problems and relationships between the different materials (metal, ceramics, glass, stone, cement, fibers) in the aspects related to their production, circulation and remaining phases of their complex biographies are growing (Hahn and Weiss 2013; Dillmann and Bellot-Gurlet 2014; Delfino *et al.* 2016; Molloy 2016; Burmeister and Bernbeck 2017; Gorgues *et al.* 2017; Stockhammer and Maran 2017). This interaction between science-based approaches and archaeological questions together with a theoretical development of technological concepts such as the one of *chaîne opératoire* or the *holistic study* proposed by Shimada (1996) and the increasingly growing need to study metallurgical development in relation to other production technologies (ceramics, lithics, ivory, cloth or even subsistence) will undoubtedly contribute to the creation of broader and more nuanced pictures of past societies.

The volume at a glance

After this introductory chapter, the book includes ten contributions organised into three sections and a final

chapter as concluding remarks. As we have already pointed out, these three sections must be understood in a permeable and flexible way given that the different modes of circulation analysed (knowledge and technology, prestige items, commodities) often coexist in space and time. Equally, we have not considered strict geographical and chronological limits, although European and Mediterranean Recent Prehistory is the main focus of this book, with occasional incursions into other areas (Figure 1.4/Colour Figure 1.4). Given that Martínón-Torres' final chapter briefly reviews the different contributions, highlighting the relevance of each of them, we will not comment on each individual chapter here. However, we will briefly refer to the content of the different sections.

The first section is entitled *Transmission of metallurgical technologies, knowledge and ideas* and comprises four chapters. The first, by Tobias L. Kienlin, is a thought-provoking and extensive critical reflection on the relations between European and Mediterranean Bronze Age societies. Focusing on the Early Bronze Age 'tell cultures' in the Carpathian Basin, the author questions the approaches based on 'Neo-Diffusionism' and the application of the World Systems Theory to the societies of this period, suggesting that the relations between the areas do not

necessarily imply the dependence of one on the other. Another two chapters in this section deal with gold. The chapter by Catalin Lazar and colleagues discusses the gold and copper finds from the Sultana – Malu Roşu site in the context of the Kodjadermen-Gumelnita-Karanovo VI culture (c. 4500–3900 BC) in southeastern Romania, attempting to define possible routes of metallurgical innovation and metal circulation. For her part, Alicia Perea offers an original comparative approach to two important goldsmith traditions, one pre-Columbian (Quimbaya), and another from Atlantic Iberia (Villena/Estremoz), which have in common their endeavour ‘for technological excellence as an intentional option to achieve empowerment and visibility’. This section closes with an extensive chapter by Bianka Nessel and colleagues on Bronze Age tin. The authors offer a review of the archaeological challenges regarding tin as well as the research carried out on tin isotopes within the aforementioned BRONZEAGETIN project, highlighting the diversity of routes and social contexts linked to the introduction and dissemination of bronze metallurgy.

Under the title *Prestige economies and exchange*, the second section contains three contributions. In the first, Michael Rowlands offers a stimulating theoretical reflection on the concept of exchange value that has important implications for understanding the circulation of metals and other products in different social systems. Susan Sherratt offers a detailed analysis on the use of silver in 4th millennium BC Mesopotamia. In her opinion, the appreciation of this metal in this specific context has to do with its physical and sensory properties (uselessness and shininess), as well as a specific degree of availability. Borja Legarra’s contribution focuses on the role of gold in Early and Middle Bronze Age Crete, highlighting the association of gold items with collective burials, and proposing that they ‘were part of a complex interplay between individual and group prestige’. Taken together, the chapters by Sherratt and Legarra constitute a solid call to attention regarding the risks of systematic associations of fine metals and individual prestige. On the contrary, the social meaning of these metals is fluid and changing, depending on diverse factors such as their availability or the degree of social division in the communities.

The third section is entitled *Circulation of metal as commodities*. In a stimulating chapter, Peter Bray discusses the extent to which the density of the scientific data allows biographical and prosopographical approaches to be applied to the study of ancient metallurgy, setting out the particular case of the Early Bronze Age Britain and Ireland analytical dataset. Next, Lene Melheim and colleagues, based on their extensive analytical work on the provenance of Scandinavian Bronze Age metals, analyse the potential role played by the northerners in Bronze Age sea-based, long-distance trade in metals. They defend a pronounced

shift in metal supplies around 1500 BC, proposing Iberia as an important source of metals during the Late Bronze Age, which would also explain the similarities in the rock art of both areas. Last but not least, Núria Rafel and colleagues summarise the results of their research in the Baix Priorat mining area (northeast Iberia), significant due to its copper and lead resources. They propose that the relationship between metallurgy and social complexity cannot be postulated in a generic way, but rather that it changes through time and space.

In his concluding chapter, Marcos Martín-Torres dissects the main thematic and plot strands of the volume, contextualising them in the current debates of the discipline. In particular, he defends the growing integration of archaeometallurgy into the general panorama of archaeological research, which would be the result of its disciplinary maturity. In his own words, ‘when we focus on the best rather than picking on the worst, I no longer recognise a neat divide between archaeology and archaeological science’.

Our explicit interpretation of archaeology, as we hope have successfully reflected in this volume, is that in order to have an holistic and complete understanding of societies, their technologies and their historical processes, both the empirical and analytical data, combined with a solid archaeological and anthropological theoretical background, are needed and must be developed as a dialectic relationship: theoretical hypotheses and backgrounds will shape the analytical methodology and techniques used in the same way as the empirical data will contribute to shaping and changing theoretical backgrounds.

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Notes

- 1 https://cordis.europa.eu/project/rcn/109308_en.html
- 2 <http://flame.arch.ox.ac.uk/>
- 3 https://cordis.europa.eu/project/rcn/89457_en.html

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Part 1

Transmission of metallurgical technologies, knowledge and ideas

Chapter 2

On Europe, the Mediterranean and the myth of passive peripheries

Tobias L. Kienlin

‘Fault lines’ revisited

When C. Renfrew (*e.g.* 1970a; 1970b; 1973) proclaimed his famous ‘Radiocarbon Revolution’ and pointed to the existence of a ‘fault line’ (Figure 2.1) in the traditional synchronisms between Europe and the Mediterranean, he was drawing on the results of scientific dating methods to question an older diffusionist paradigm epitomised by the work of V. G. Childe (*e.g.* 1929; 1957). In particular, it was the demonstration of the autochthonous development of metallurgy in Europe that Renfrew was concerned with. In a series of studies, he reviewed the chronological links traditionally drawn between early metal-using groups of the European Copper and Bronze Ages and the Mediterranean, as well as the Near East (*e.g.* Renfrew 1968; 1969; 1978; 1979). As a result, Renfrew (1970a) came up with his equally influential ‘isochronic map’, which indicated the existence of independent core areas of early metallurgy in southeastern Europe, as well as on the Iberian Peninsula. In this context, scientific methods were employed not only for dating but also for provenancing and to establish that various kinds of elaborately crafted objects, such as faience beads, were indeed of European origin instead of being imports from the allegedly superior civilisations of the East (*e.g.* Newton and Renfrew 1970).

The ‘New Archaeology’ or ‘Processual Archaeology’, which sprang from these beginnings, however, was not just about the application of scientific methods to address questions of chronology and origins. Rather, the archaeological record was attributed a quality of its own, which, it was claimed, was not adequately captured by quasi-historical narratives and related interpretative concepts such as migration. Archaeological ‘cultures’ were no longer thought to ‘behave’ in a similar way as historical ‘actors’, and diffusion was questioned as a model to account for

culture change. Instead, attention was drawn to the dynamics of European ‘peripheral’ societies and their potential for social and technological development. Here lies the lasting merit of Processual Archaeology, and it is worth recalling Renfrew’s (1973, 112) original programmatic claim: ‘What matters is not to know whether some ingenious idea reached the society in question from outside, but rather to understand how it came to be accepted by that society, and what features of the economic and social organisation there made the innovation so significant’.

‘Fault lines’, then, are not an analytical concept, but merely a descriptive term that was launched in the first place to draw attention to problems in traditional cross-dating and the absolute chronology of European prehistory. It must not be used, of course, to deny interregional interaction and exchange, if there is corresponding evidence, and Processual Archaeology has been rightly criticised for neglecting the potential impact of a wider historical setting on local systems. In the meantime, however, we witness the opposite development with various brands of ‘Neo-Diffusionism’ predominating, derived from either traditional (including scientific) approaches or a reading of World System Theory and its modifications.¹ It is in this context, too, that we see the return of grand narratives that have us believe in the dependency of European societies of the Bronze Age on the Mediterranean, and/or the convergence of both areas, without actually producing evidence to support such bold claims.² For this reason, an attempt is made in this paper to deconstruct some of the widely held notions in Bronze Age research that involve bridging the gap between socially and culturally distinct societies, widely set apart in space and/or in time, in order to produce the unified Bronze Age narrative commonly accepted. It argues instead for an approach that leaves behind essentialising concepts of

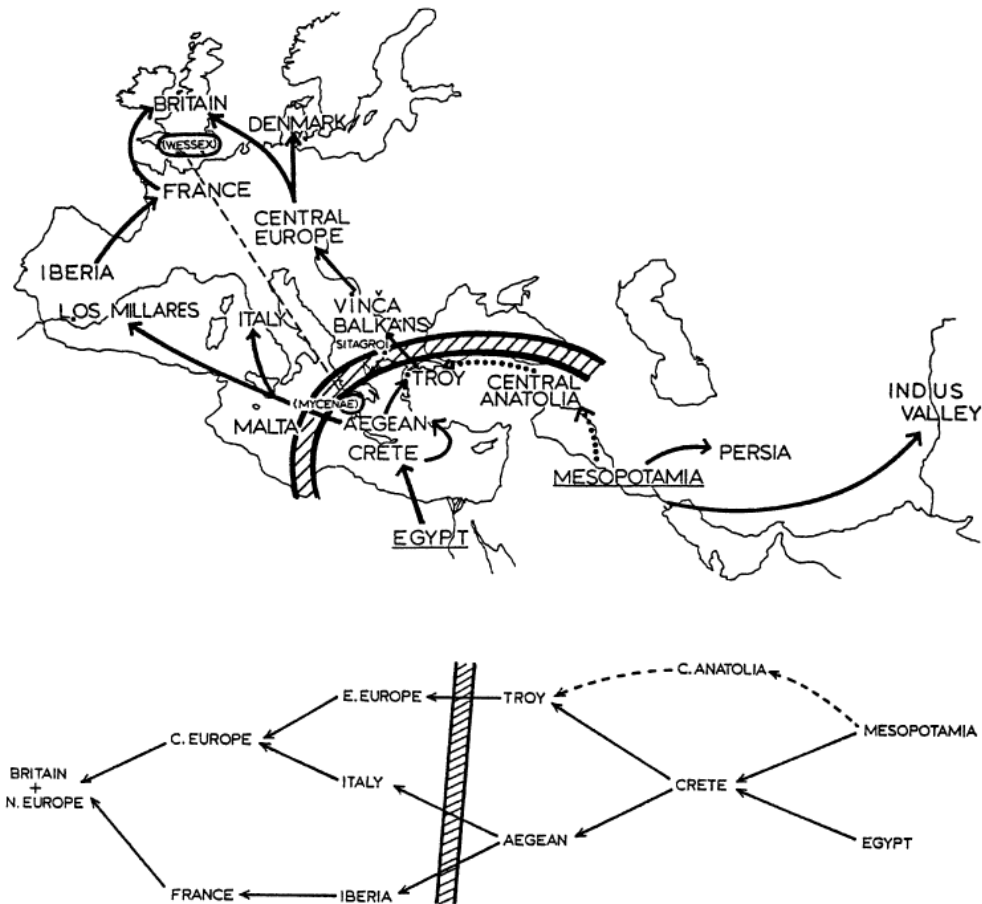


Figure 2.1 'Fault line' in the traditional cross-dating synchronisms between Europe and the Mediterranean (after Renfrew 1970a, 289, fig. 3b; 291, fig. 4)

'core' and 'periphery' and allows for the variability and historicity of potentially interacting local groups – both from the Mediterranean and Bronze Age 'Barbarian' Europe.

In a metaphorical sense, then, the notion of a 'fault line' may be useful to remind us that the elegance of historical narratives and the consistency of world-view involved in archaeological writing do not adequately support claims to historical 'truth'. In a more down-to-earth sense the notion of a 'fault line' between societies of the Aegean Bronze Age and those further north, in the Balkans and into the Carpathian Basin, may allow us to consider that long-term stability of structural differences between groups coexisting in time and space clearly *is* a possibility, and that mere proof of contact and/or contemporaneity does not equal demonstration of 'core' impact on the less developed 'periphery'.

The approach taken is by way of example. It will focus on the modelling of the 'chiefly courts' of the Early Bronze Age 'tell cultures' in the Carpathian Basin in the widely read synthesis *The Rise of Bronze Age Society* (Kristiansen and Larsson 2005),³ which is thought to epitomise and exaggerate notions widely held in Bronze Age research, albeit not often expressed in such a straightforward manner.⁴

As such, Kristiansen and Larsson's argument heavily depends upon some kind of core and periphery model, with prehistoric Europe situated on the margin of Mediterranean urban or palatial centres, that developed from the earlier work of one of the authors (e.g. Kristiansen 1987; 1998). In *The Rise of Bronze Age Society* such elements derived from World System Theory are still present, but there is a shift towards ritual and a Bronze Age elite *ethos* which supposedly held the 'system' together (cf. Harding 2013, 383–84). Very much like before, however, 'institutional' similarity, 'systemic' interrelation and the effect of contact on 'peripheral' society are still taken for granted rather than being demonstrated.

In such studies regional variability in both the 'core' and the 'periphery' is ignored and subsumed in the grand narrative given. The meaning of exotic objects, such as foreign swords, in peripheral or marginal groups is taken to be identical with their origins instead of being understood as renegotiated in local contexts (Piccolini and Kienlin forthcoming will provide an alternative approach). At no point is an attempt made to study the appropriation and recontextualisation of foreign elements – material and

immaterial – in the periphery, and we are led to believe in ‘passive’ peripheries that fall victim to overwhelming outside influence. This kind of theorising falls short of more recent interaction studies, for example in Mediterranean Archaeology, where a much more complex picture of ‘core’ and ‘periphery’ relations emerges than just dependency, subordination and exploitation. Without denying contact and interaction, systemic dependency as previously postulated is found difficult to establish. Attention is drawn to the differential outcomes of contact and exchange depending on local valuations, specific historical trajectories and peripheral choice or agency opposite outside ‘influence’.

In line with previous publications, it is argued, therefore, that core and periphery-type interpretations of the Bronze Age tell-‘building’ communities of the Carpathian Basin, mirroring the Mediterranean, have to be revised (e.g. Kienlin 2012; 2015a; 2015b). It is argued that we should not try to account for this type of settlement and the social and cultural life of its inhabitants in terms more or less explicitly derived from the palatial centres of the Bronze Age Aegean and beyond. It is suggested that, instead, Bronze Age research should take an interest in continuities from the previous Neolithic and may profitably look for inspiration in a different tradition of Neolithic research and post-processual approaches to Late Neolithic tell sites of the same region. Correspondingly, it is taken as established that the beginnings of Early Bronze Age tells in the Carpathian Basin predate the Mycenaean palaces, and even the shaft grave period; and it is assumed that previous contact with Minoan palatial society, if any contact existed at all, was such that it did not significantly affect local trajectories.⁵ It is further assumed that there is no break in local development, say from the Early to the Middle Bronze Age in Hungarian terms, that may be related to a gradual expansion of Mycenaean influence and interest further north. In other words, the position taken here is that Bronze Age tell-‘building’ societies of the Carpathian Basin developed largely on their own. We must refer, therefore, to the internal logic of these cultures, and not to foreign contacts, for an understanding of their settlement, their use of material culture and their construction of social space. Foreign contacts, ultimately extending towards the Mediterranean, may be established by sporadic import finds, but this did not result in broader convergence between the two societies, be it social, economic, or ideological.

World Systems and Neo-Diffusionism

Kristiansen and Larsson argue ‘... that the study of later European prehistory, and especially the Bronze Age, has failed to make convincing progress because among other things it is dominated by a farming or peasant ideology of immobility which is derived from a more recent European past. By implicitly assuming that prehistoric farmers were

as immobile as their historic counterparts, archaeologists have failed to grasp the specific historic character of the Bronze Age: they have failed to recognise its “otherness” (Kristiansen and Larsson 2005, 32, see also 367–68). Instead, the authors go on to suggest that the Bronze Age is characterised by a high degree of mobility and travelling to distant places, especially on the part of newly emergent warriors or ‘chiefly’ elites, and the transmission of foreign esoteric knowledge that these people were able to draw upon back home in order to enhance their social standing. Consequently, the Bronze Age is thought to have seen a far-ranging alignment of socio-political and ideological ‘institutions’ alongside the more conventional intensification of trade and exchange and the general economic upswing expected in the wake of bronze metallurgy (e.g. Kristiansen and Larsson 2005, 32–61).

In a way, this is a particularly eloquent phrasing of a widely held view in Bronze Age research, which has it that the Bronze Age was qualitatively different from the preceding Neolithic and historically unique on a pan-European scale. We are led to expect the emergence of (proto-) urban settlements drawing on an agricultural surplus from their surroundings, featuring craft production and exercising control of exchange with exotic objects and raw materials from abroad.⁶ Supposedly, there were peasants, craft specialists and those in charge – a warrior elite that developed new forms of male self-representation, for example by their command of shining bronze weaponry; aggrandisers whose competitiveness propelled Bronze Age society onto a new stage of social evolution, ultimately in likeness of the urban centres of the ancient Near East or the palaces of the Bronze Age Aegean.

However, the work of Kristiansen and Larsson goes beyond most of this ‘traditional’ archaeological reasoning, for it is more consistently argued, and it features a powerful narrative and construction of a Bronze Age ‘other’. This is why their study is so enormously attractive for some, and has attracted fierce criticism by others from the start.⁷ Among several other points it has been noted that regional variability is systematically subdued up to the point that evidence to the contrary seems to have been deliberately ignored. The same certainly holds true for opposing theoretical approaches. Such problems are closely related to the specific narrative style of their presentation that in some places borders on epic writing instead of scientific prose. It is well worthwhile, therefore, to have a closer look at the strategies involved in the presentation of this particular Bronze Age ‘other’ and to draw attention to some alternative views.

There are different avenues that such an attempt at deconstructing *The Rise of Bronze Age Society* may take, not least the heavy reliance of Kristiansen and Larsson’s study on the ethnographic work of Mary Helms (e.g. 1979; 1988) to support their notion of Bronze Age ‘travellers’ (e.g. Kristiansen and Larsson 2005, 2, 17, 39–41, 45–47,

51–57), and their bridging the gap between the Early Iron Age Homeric heroes and the Mycenaean Bronze Age (e.g. Kristiansen and Larsson 2005, 22, 28, 61, 101–5, 227, 247). Instead, we will focus here on the attempt to overcome the divide between the Late Bronze Age Mycenaean palaces and wider Bronze Age ‘Barbarian’ Europe. The result is much the same as in the example of Mycenaean and Homeric society (cf. Kienlin 2015b, 155–66), for groups are linked which are widely different in social and cultural terms: Mycenaean and beyond that, of course, Minoan palatial society firmly rooted in the tradition of eastern Mediterranean Bronze Age civilisation and the peasant or ‘proto-urban’ communities of the wider southeastern and central European hinterland.

In essence, this is close to the traditional *Ex Oriente Lux* paradigm, since it assumes foreign influence and Mediterranean impact on prehistoric European societies. For this reason, *The Rise of Bronze Age Society* has been rightly dubbed ‘neo-diffusionist’ (Chapman 2013, 331). Its authors certainly take sides with all those scholars specialising in the European Bronze and Iron Ages who are spellbound by the impressive palatial or urban centres of the Mediterranean and the Near East that coexisted with their own less ‘impressive’ objects of study. However, while for many adherents of this approach it is simply a matter of fact that evidence of contemporaneity and *contact* with the superior societies of the eastern Mediterranean equals eastern *influence* on the less sophisticated but receptive groups of ‘Barbarian’ Europe, for Kristiansen and Larsson things are somewhat more complex. They subscribe to a core and periphery model that seeks to account in explicitly systemic terms for the effect of interregional interaction and asymmetric exchange on European Bronze Age societies. This kind of thinking goes back to World System Theory as proposed by Wallerstein (2011 [1974]), and basic assumptions central to the original model are still perceptible in the various modifications that seek to adapt this approach to precapitalist societies.

It is necessary, therefore, to review some central tenets of World System Theory, its adaptations and its current applications.⁸ It will become clear that often ‘systemic’ interdependence is not adequately demonstrated. Our understanding of specific local trajectories requires an approach that encompasses the internal logics of culture systems and the agency of individual people or social groups. It cannot be replaced by the outside view or the supposed logic – be it economic or other – of the structural components of an overarching abstract interregional system. Instead, an emphasis on local agency *vis-à-vis* foreign contact or foreign goods is required, along with a focus on local recontextualisations and revaluations of material culture, as well as externally-derived immaterial concepts.

‘World System Theory’ after I. Wallerstein (e.g. 2011, xvii–xxx, 3–17, 347–57) represents an attempt to account

for the emergence of underdevelopment in the wake of European colonisation and imperialism in terms of structured interaction, systemic (economic) dependency, geographical division of labour and unequal exchange. It is argued that all of these were to the disadvantage of peripheral societies which were confronted with an industrialised, politically ‘superior’ European core area represented by colonial powers such as Spain, Portugal, France and, in particular, Great Britain. This was an advance over previous accounts for the ‘rise of the West’ in essentialising terms of an inherent superiority of European culture and society, as well as over earlier ‘Dependency Theory’ (cf. Rowlands 1987, 1–3; Champion 1989, 2–9). Yet, Wallerstein himself was accused of morally ‘well-meant’ Orientalism (Washbrook 1990, 492), because his periphery is assigned the role of passive victim to European expansion. It is denied internal social or cultural dynamics and agency in opposition to outside invaders, foreign material culture, or immaterial concepts such as imperial rule, ideology or religious beliefs (Sahlins 1994, 412–13; Stein 1999a, 16–23; 1999b, 154–57).

Setting aside the criticism aimed at the adequacy of World System Theory to understand the structure and development of *modern* core and periphery relations themselves (e.g. Sahlins 1994, 412–16; Kümmel 2001, 23–24; Wolf 2010, 22–23, 297–98), it is somewhat surprising that this approach was so readily accepted into the archaeological discourse. Wallerstein (2011, 15–129, 162, 301–44) himself had made it quite clear that he regarded his World System as the consequence of an historically specific juncture, *i.e.* industrialisation and the development of capitalism in the modern West. With regard to earlier, pre-modern periods his position was akin to substantivism in that he thought such economies and their potential interaction qualitatively different from modern times (cf. Rowlands 1987, 3; Kohl 1987, 13–14; Champion 1989, 5–8; Galaty 2011, 9). He claimed that, at best, political structures or ‘world empires’ may have evolved in pre-modern times. These lacked, however, the technological and organisational potential to establish stable structures of economic domination that extended over wider areas for any extended period of time (Wallerstein 2011, 15–17, 348–51; cf. Champion 1989, 6).

In view of these limitations, the impact of Wallerstein’s World System Theory on archaeological thought can only be understood as a response to the then prevalent Processual Archaeology with its heavy emphasis on local trajectories. World System Theory was adopted to shift back focus to the importance of long-distance interaction, interregional exchange, and the effect this may have had on local systems (e.g. Rowlands 1987, 3–11; Champion 1989, 1–2). Given Wallerstein’s own reluctance in these matters, an important strand of this debate is concerned with the applicability of his model to pre-modern societies. Most of this ultimately refers back to J. Schneider’s (1991 [1977]) influential review, where it was claimed that Wallerstein had unduly

limited the range of his own model by denying the exchange of luxury goods a similar impact on local economy and society as suggested for bulk exchange of raw materials and industrial goods in the modern World System.

Subsequently, there was a pervasive use of various brands of ethnographically-derived ‘prestige goods economies’ to account for the emergence of inequality in prehistoric European groups. Not every such attempt to identify a ‘prestige goods system’ in operation is linked to wider notions of the society in question being situated on the ‘periphery’ of a Mediterranean or Near Eastern civilisation or ‘core’ area. However, both strands of the debate are close in their joint interest in the structuring potential of foreign-derived (prestige) goods on social relations (*cf.* Rowlands 1987, 4–8; Champion 1989, 8, 11–13; Kümmel 2001, 26–33, 73–76). The spread of World System terminology was favoured by the ready-made mechanism that this model provided to account for the nature and perceived effect of structured interregional interaction by reference to elite exchange of valuables. Thus, ever more groups ascribed to prehistoric Europe and beyond are discussed in terms of ‘core’ and ‘periphery’ or ‘margin’, although they would seem widely different in terms of their internal organisation, as well as with regard to the mechanisms and intensity of their interaction.⁹

Of the authors of *The Rise of Bronze Age Society*, it is Kristiansen, in particular, who is known for his long-standing interest in the application of core and periphery models in archaeology. It is necessary, therefore, to have a look at some of his studies over the last decades in order to highlight the difficulties with this approach in a European context. Kristiansen’s use of World System Theory has been rightly classified as ‘macrohistorical’ (Kümmel 2001, 90, 94–97; see also Barrett 1998, 20–21), since, in his work, elements of World System Theory are incorporated into ever wider syntheses of the evolution of European societies of the Bronze and Iron Ages (see also Kienlin 1999, 109–23). Starting on a relatively modest scale, in his paper on ‘Center and Periphery in Bronze Age Scandinavia’, Kristiansen (1987, 81–84) drew on Ekholm and Friedman’s (1985, 114–15) concept of dependent and independent structures to allow for regional variability in prehistoric Europe. Unsurprisingly, Scandinavia was declared dependent on central Europe. Both areas were thought to have been linked by an unbalanced exchange of bronze objects that peripheral Scandinavian elites were claimed to have drawn upon to attain their status. This is, of course, the classic prestige goods exchange modification to Wallerstein’s original model that is widely used in archaeology, although Kristiansen (1987, 77–79), from the beginning, added a distinctly ritual ‘flavour’ by reference to the work of M. Helms (1979; plus, of course, in Kristiansen’s subsequent work, reference to Helms 1988; 1993; 1998). Thus, economically derived power, social pre-eminence derived from control over

(foreign) prestigious objects and ‘mythical’ power related to outside contacts, control of wondrous foreign objects and esoteric knowledge attached to them all tend to be conflated (Kristiansen 1987, 77). From Wallerstein this takes the interest in systemic dependency and unbalanced exchange (although of a different kind than in the original) – elements that also feature prominently in Kristiansen’s subsequent papers, and in his major work *Europe before History* (Kristiansen 1998). Here, the logic of the system and the mechanisms involved are the same as before, namely asymmetric elite exchange networks (*e.g.* Kristiansen 1998, 249–52). However, the scope of the study is widened to comprise a Bronze Age and Early Iron Age World System that is thought to have incorporated the whole of Europe and the Mediterranean (Kristiansen 1998, 359–419). In addition, there is an explicit interest taken in cyclical evolutionary patterns that is also derived from World System Theory (*e.g.* Kristiansen 1998, 50–53, 407–17). Finally, in the 2005 synthesis *The Rise of Bronze Age Society* (Kristiansen and Larsson 2005), all of these elements are still present, yet as has already been pointed out, there is a distinct shift towards the ‘intangible’ (Harding 2013, 383–84; see also Galaty, Tomas and Parkinson 2014), since centres and peripheries are linked by ritual, esoteric knowledge and foreign objects that travelling elites obtained from abroad, not merely via economic or political exchanges (*e.g.* Kristiansen and Larsson 2005, 4–7, 10–13, 20–31; see also Kristiansen 2011). Much of this reasoning leaves World System Theory behind, most clearly in that the concern is no longer so much with dependency, but rather with convergence, since in the end it is fundamentally the same Bronze Age ideology, with its accompanying symbols and institutions, that is detected all over the Old World during the 2nd millennium BC (*e.g.* Kristiansen and Larsson 2005, 142–250).

Alternative approaches

It is certainly true that prehistoric groups must not be studied in isolation, if we want to understand their development. It is also true that evidence for trade or exchange and the presence of foreign (prestigious) objects need to be accounted for, and their significance for local people and economy has to be evaluated. Yet, if World System Theory and encapsulated notions of prestige goods economies may theoretically hold promise to explain at least some such constellations, in practice their explanatory power is severely hampered by the common failure to demonstrate systemic interlinkage and the validity of the mechanisms and the causality of socio-political change thought to have been involved. Such problems have, of course, been noted for some time now.¹⁰ They refer to key assumptions of the model and may be summarised as follows: a) problems of definition and delimiting perceived ‘core’ area(s) and ‘peripheries’ including problems of demonstrating structural difference

between the two in aspects relevant to the operation of the system (*e.g.* Kohl 1987, 16–18; 2011, 81–85); b) failure to demonstrate *structured* interaction and *systemic* (economic) dependency between perceived core and periphery (instead of mere contemporaneity, general contact and exchange); c) partly related to points a) and b) failure to demonstrate asymmetry in structured interaction to the disadvantage of the periphery (*e.g.* division of labour and terms of trade favouring the core) and consequent dominance of core polities and elites over peripheral groups (*e.g.* Kohl 1987, 16; Stein 1999a, 23–24; 1999b, 155–59; 2002, 904–5); and d) failure to establish why (and how) ‘asymmetric’ exchange – as defined by the contemporary archaeological observer – should always translate into growing disparity between core and periphery (Dietler 1990, 353–58; 2005, 59–61; 2010, 48–49; Kümmel 2001, 86–88). This latter point, of course, refers to the unproven assumption that peripheral prestige goods economies will politically end up in competition and spiralling asymmetries, while economically, specialisation and unequal exchange will in the long run have a devastating effect on peripheral society and cause decline relative to the core of the system.

It is telling that much of this criticism was launched early on in Near Eastern Archaeology (*e.g.* Kohl 1987; 2011; Stein 1999a; 1999b; 2002; 2005a; 2005b), *i.e.* in an area where the outside observer would have expected comparatively little difficulties in the application of World System Theory (*e.g.* Algaze 2005; Beaujard 2011). If anywhere in prehistory, should not the emergent urban centres of Mesopotamia or the Egyptian civilisation qualify as core areas? Should they not have dominated, in economic terms, their respective peripheries, such as Anatolia or the Zagros mountains, by supplying elaborately crafted goods and textiles in return for raw materials such as metal, stone or wood that were not available on the floodplains? And should not this situation bear the greatest potential to resemble a modern colonial encounter with its systemic interdependence and exchange to the disadvantage of less developed peripheral groups? Yet, it is here that some of the more prominent critiques of World System Theory were developed, and a growing number of authors from Mediterranean Archaeology seek to integrate interaction studies with a broader postcolonial concern with agency and the negotiation of local identities in specific historical contexts (*e.g.* Hall 1992; Said 2003 [1978]; Bhabha 2004 [1994]; Conrad *et al.* 2013).

Drawing on the early recognition that in prehistory even politically centralised and economically strong ‘core’ states lacked the technological and infrastructural ability to project their power over large distances (Stein 1999a, 55–64; 1999b, 160–65), there is a growing awareness that culture, too, in the form of local traditions, local values, systems of knowledge or notions of the world and society may delay or forestall core dominance over peripheral groups (*e.g.* Gosden 2001, 243; Dietler 2005, 56; 2010, 46; Wengrow

2011, 136–37, 141; Bachhuber 2011, 164–71). Without denying contact and interaction, it is found difficult to demonstrate systemic dependency as previously postulated, and one turns away from the study of interaction in mere economic terms (see van Dommelen 2005, 113–15). Instead, attention is drawn to the differential outcomes of contact and exchange depending on local valuations, specific historical trajectories and peripheral choice or agency opposite outside ‘influence’.¹¹ It is increasingly agreed upon, that neither comprehensive concepts such as an ideology of legitimate political power, social strategies and practices, nor symbolically charged objects such as valuables or prestige goods are likely to remain unaffected in their specific meaning and potential to be drawn upon in local discourse when transferred from ‘core’ to ‘periphery’. Rather, there is an active choice in selecting concepts or objects that ‘fit’ into existing notions of the world or social strategies (*e.g.* Dietler 1989, 134–36; 1998, 303–7; 2006, 232–35). Any foreign element, therefore, that makes its way into a new context, is likely to undergo an act of ‘translation’, *i.e.* an active reinterpretation of its meaning and an effective recontextualisation to establish its specific positioning and role in local practice and discourse.¹² Hence, for example, it cannot be taken for granted that some foreign ‘prestigious’ or ‘sacral’ objects automatically received the same appreciation in peripheral groups and were drawn upon to support elite claims to exotic foreign knowledge. This is all the more true, when such objects had trickled down some contingent line of exchange rather than being handed over directly with an accompanying narrative to support their significance (Bachhuber 2011, 166; Legarra Herrero 2011, 274). Both ‘import’ by whatever means and local emulation involve a transformation of meaning (*e.g.* Stein 1999a, 66), and neither systemic interdependence nor asymmetry of exchange is an indispensable consequence of contact (*e.g.* Dietler 1989, 135–36; Stein 1999b, 157; 2002, 907–8; Kohl 2011, 80–81). That is to say that the effect of contact and exchange must not be taken for granted. The occurrence of foreign derived immaterial notions and material culture has to be studied by reference to their actual use in a new context. Foreign elements have to be understood in terms of their specific reworking by local communities and individuals. Their potential to destabilise local traditions and social order must not be unduly emphasised.

Europe and the Mediterranean

Unfortunately, with few exceptions, little of this theoretical development has so far been applied to the prehistoric European ‘periphery’ of a postulated Mediterranean ‘core’ area.¹³ This is particularly true for Bronze Age research, which in the wake of spectacular finds like the Nebra disc has seen a return to the old *Ex Oriente Lux* paradigm in recent years.¹⁴ To many, of course, who never subscribed to the

processual paradigm of autochthonous development, this is simply the return to what they have known all along. Popular volumes like *Europe before History* (Kristiansen 1998) or *The Rise of Bronze Age Society* (Kristiansen and Larsson 2005) are hailed for their elegant and comprehensive review of our perceived state of knowledge (see also, of course, the work of A. Sherratt e.g. 1993a; 1993b; 1994; 1997). They carry forward the conviction that somehow ‘contact’ makes a difference and will affect culture and society on the periphery. Inspired by World System Theory we still see here an interest in systemic dependency, unbalanced exchange and cyclical evolutionary patterns (e.g. Kristiansen 1998, 50–53, 407–17). Besides, more recently there is a shift towards the ‘intangible’ (Harding 2013, 383–84), since centres and peripheries are now understood to be linked by ritual, esoteric knowledge and foreign objects (e.g. Kristiansen and Larsson 2005, 4–7, 10–13, 20–31; Kristiansen 2010; 2011).

This kind of narrative is often appealing and invites one to ignore the pitfalls inherent in the argument. The current modelling of the ‘chiefly courts’ of the Bronze Age tell communities already mentioned provides a good example of such problems. These groups certainly seem situated on the southeastern European ‘margin’ of presumably more ‘advanced’ societies of the Mediterranean. They have, in any case, been discussed in this context, whereby different approaches can be observed: The economic impact of long-distance trade in metal and other commodities may be stressed, or the social dynamics of prestige goods exchange drawing on exotic foreign material culture.¹⁵ More often than not this involves the decontextualisation of foreign elements, if any are present at all. Their use and meaning is taken for granted, and the ‘findings’ of this kind of analysis attain the status of confirmed historical ‘fact’ when actually they run counter to a broader contextual examination of the groups under discussion (cf. Kienlin 2012; 2015a). Just consider the following passage (Kristiansen and Larsson 2005, 167):

Visitors to the chiefly courts in the north-western Carpathians during the seventeenth and sixteenth centuries BC would have met a shining world of painted/decorated houses in east Mediterranean imitation, chariots, new weapons and new exotic rituals of drinking and feasting ... The chiefly courts of the tell cultures combined a strong innovative local tradition in pottery and metalwork with exotic cultural traits from the Minoans and Mycenaeans, whom they met regularly at some of the trading points. Even script – the mysterious powerful script – did they want to adopt. Not for recording their possessions or tribute payments ... but as a powerful, esoteric ritual.

All of this is problematic since the grand scale of the narrative and its distance from the evidence on the ground tend to defy critical assessment, and most of the general criticism still applies that was directed against archaeological reasoning

inspired by World System Theory during the last decades (cf. Harding 2013). What chiefly courts, one may ask then,¹⁶ and what evidence of script? But let us dwell instead on the supposed implications of this ‘finding’: Bronze Age communities in the Carpathian Basin are thought to have adopted fundamental institutions of Minoan/Mycenaean civilisation, such as ‘exotic rituals of drinking and feasting’. Other elements, such as writing and script are thought to have been adapted locally and somehow transformed into a ‘powerful, esoteric ritual’ (Kristiansen and Larsson 2005, 167). Yet in sum, it is suggested, we see a process of adoption and convergence, and this ‘shining world’ in ‘Mediterranean imitation’ is clearly thought to have seen the direct transmission of religious and social institutions (e.g. Kristiansen and Larsson 2005, 150–67). Now, one might argue that even if the tell communities under discussion had in fact used Mediterranean script, which they did not, this use as ‘mysterious signs of powerful and esoteric ritual’ would point to the exact opposite of what is suggested: namely recontextualisation and appropriation into a local context and local practices different from the Mediterranean rather than the transmission of institutions such as true Mycenaean palace administration.

Apart from an essentialist conception of groups like the ‘Minoans’ and the ‘Mycenaeans’ and overt simplification in the presentation of Mediterranean and European sequences, there is no demonstration, other than broad contemporaneity, as to why and by what mechanism change in one part of the ‘system’ should have affected society in another. The recontextualisation of foreign elements – material or immaterial – and the actual strategies of their use in the periphery are not explicated in any detail. Instead, by and large the meaning of foreign objects and goods is taken for granted (e.g. Kristiansen and Larsson 2005, 29, 142–50). Given the approaches in Mediterranean and Near Eastern Archaeology mentioned above, such convergence and largely identical meanings should come as a surprise. In any case, this assumption would require careful demonstration. The same holds true for the claim that social ‘institutions’ can be identified from their (symbolic) material remains (e.g. Kristiansen and Larsson 2005, 10–31), and that the more complex such symbolic structures and the corresponding package of knowledge and practices the easier is their intact transmission (e.g. Kristiansen and Larsson 2005, 21–22, 28–29). Rather the opposite seems likely with regard to current approaches that stress the renegotiation and the transformation of identities, of meaning and practice in contact situations. We are confronted, essentially, with an invitation to *believe* in identical meanings and institutions throughout Bronze Age centre and periphery. Adherents of postcolonial studies, on the other hand, would stress the ‘hybridity’ or rather the process of ‘hybridisation’ of material culture and social practices as a result of contact and interaction. Either way, this has to be demonstrated

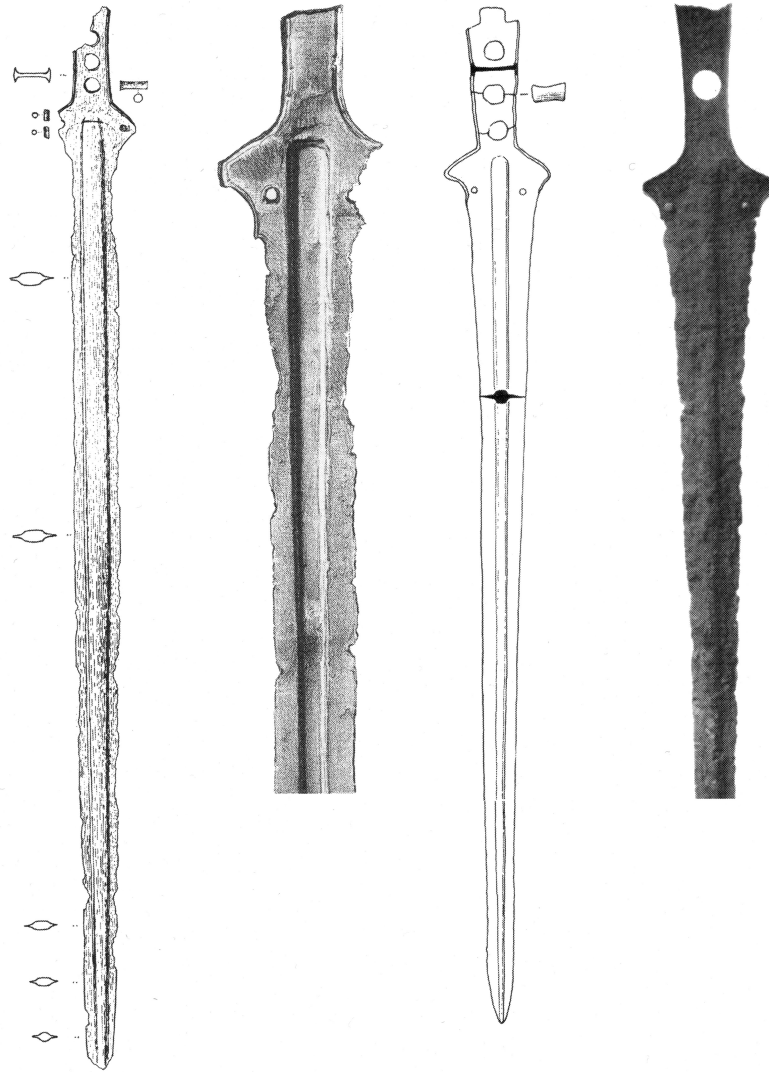


Figure 2.2 Comparison between Mycenaean flange-hilted swords (on the right) and their northern and western European equivalents (on the left) (after Kristiansen and Larsson 2005, 131, fig. 47b)

by reference to specific situations of contact and by a careful examination of the archaeological evidence, rather than taking refuge in empathy and authoritative statement (e.g. Kristiansen and Larsson 2005, 43). Yet, the latter still prevails, and this is why it can still be said that the presence of a Mycenaean sword or spiral motive in the Carpathian Basin equals the adoption of Mycenaean warrior ideology (e.g. Kristiansen and Larsson 2005, 128–32), while, for example, in Minoan studies Egyptian scarabs *etc.* in Cretan tombs are understood to be drawn upon in a specifically Minoan way to express local identities and negotiate social power.¹⁷

Correspondingly, when the European Bronze Age is thought of as an interconnected ‘globalised’ world of ‘traveling cultures’ and the distribution of specific sword types (Figure 2.2) a reflection of pan-European social ‘institutions’ (e.g. Kristiansen and Suchowska-Ducke 2015,

371),¹⁸ one wonders what happened to ‘context’ – the one category to survive, largely uncontested, from Post-processual Archaeology into contemporary archaeological reasoning. For it *does* matter that there is variability in depositional practice, and, to refer just to the very broad pattern, that such swords in Scandinavia, south-central Europe and Mycenaean Greece appear in graves whereas in the Carpathian Basin their majority is recovered from hoards.¹⁹ Such contextual variation stems from different social practices and their specific materiality. This clearly speaks *against* identical meanings or ‘institutions’ and *for* local ‘appropriation’ in its stead, *i.e.* the transformation or ‘translation’ of any potential outside influence. The difference apparent even from a cursory review of the evidence may be cast into ‘biographical’ terms (Piccolini and Kienlin forthcoming): We see interwoven biographies of males and swords. However, these did depart at different

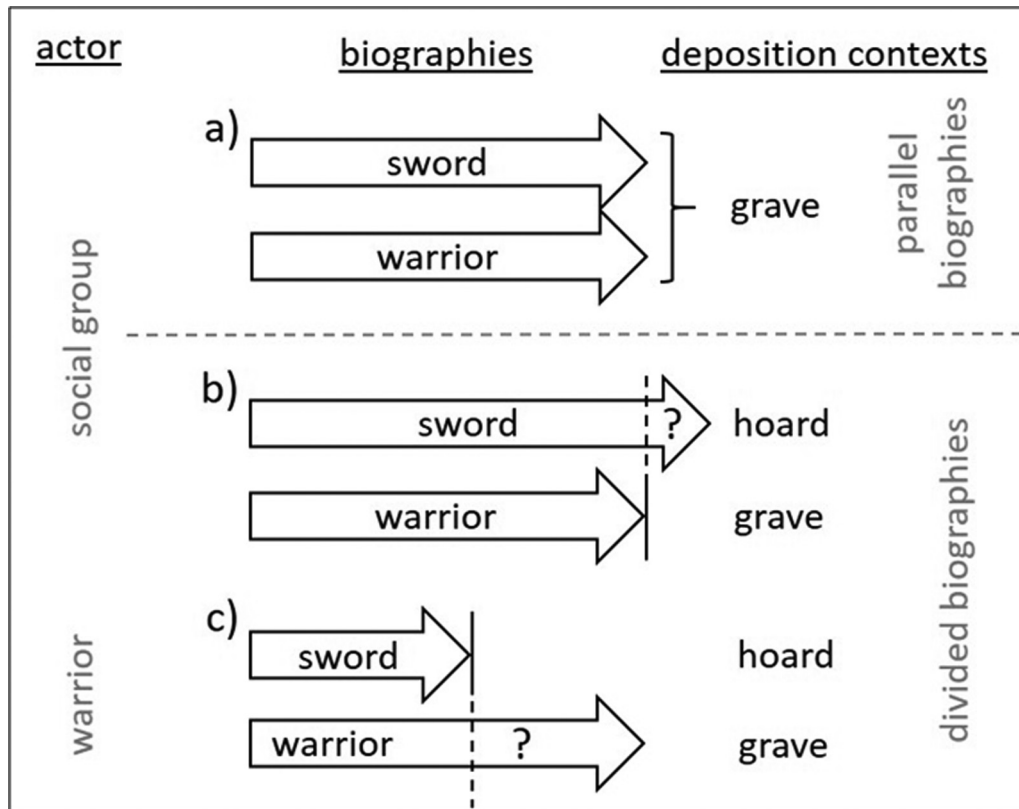


Figure 2.3 Different possible interwoven biographies of warriors and swords (courtesy of Tim Piccolini; see also Piccolini and Kienlin forthcoming)

stages in the various parts of Europe where such swords occur (Figure 2.3). In the north and south such biographies would have been broadly parallel throughout the respective lifespan of males and swords, and into their burial. In the area in between there is potentially an earlier division (*i.e.* the deposition of swords by the ‘warrior’ himself or in the context of ritual action involving a larger social group, *etc.*) indicative of different perceptions of the ‘warrior’ as such, or, more specifically, of what it meant to be a ‘warrior’ throughout or at different stages of one’s life (*e.g.* the abandonment of active fighting at a certain age; not, however, in this context in death and burial). Such variability in the association of males and swords is not a chance effect of some unknown forces operating randomly upon the archaeological record. Nor is, for example, the systematic absence of swords from graves in some regions to be ignored because social institutions like the ‘warrior’ purportedly may have existed independent of their specific material manifestations. Rather such divergent choices and decisions made are just one example of the different notions of personhood and corresponding options for social action that we have to be aware of throughout Bronze Age Europe. We have to take an interest in the variability of the archaeological record in time and space; an interest, that is to say, in the different material conditions available for social

action, the different perceptions and meanings attributed to material culture. Against this background it is highly unlikely that the same or just similar objects are representing anything like pan-European Bronze Age social ‘institutions’.

Turning back, finally, to the legacy of ‘original’ World System Theory, it is the lasting failure to demonstrate systemic dependency between Europe and the Mediterranean or between different parts of Europe that requires some additional comment. Instead, the existence of a system is proclaimed, and its development through time and its specific regional expressions are discussed in terms of the internal logic of the approach taken (*e.g.* Kristiansen 1998, 13–14, 52, 56, 359–94). The same applies to ‘world economy’ and asymmetric exchange, and one may ask to the contrary, which Bronze Age polities in Europe beyond the Mycenaean palaces themselves had ever obtained territorial control and did exert military and economic power beyond that territory, thus constituting an early economic system (*e.g.* Kristiansen 1998, 56–62)? On a more fundamental level, one has to ask, why exchange between such ‘cores’ and ‘peripheries’, if any, should have been asymmetric (*e.g.* Kristiansen 1998, 252)? This point had already been raised in the debate following Wallerstein’s original publication, and the same criticism applies to World System Theory’s archaeological variant with prestige goods exchange supposedly drawing

peripheries into a spiral of elite competition and growing dependency on core valuables.²⁰

Thus, for example, peripheral elites in the Carpathian Basin may well have been drawing on Mycenaean ornaments and armour. Yet, (early) Mycenaean elites themselves had come to depend for their social reproduction, for instance, on amber from the north and in part elaborately crafted exotic objects from Minoan Crete (e.g. Maran 2011, 284–89; Rutter 2012, 79–82). It is entirely unclear, if in such exchange any side would have been in a stronger position, or if this is the right question to ask at all. For Mycenae it has been shown that amber objects, which ultimately derived from Wessex, were put to different uses other than just jewellery, as was the case in their country of origin. The meanings ascribed to them were different, possibly magic or apotropaic. We see evidence of a complex process of ‘translation’, which also affected Minoan derived objects, rather than just simple transmission of foreign objects and their associated meanings (Maran 2011, 289; 2013, 147–51, 157–59, 161). The same applies to ‘Barbarian’ Europe. The movement of goods and objects is the result of the negotiation of specific needs and interests on both sides involved in exchange. These interests may be economically, socially and/or culturally motivated. We do not know how these motivations were distributed on the ‘core’ and ‘periphery’ sides respectively. We cannot be sure that our perception of ‘asymmetry’ in such systems adequately reflects emic notions that both ‘partners’ held of the relative ‘success’ of exchange, and their respective ‘gain’ drawn from contact and the objects, knowledge, *etc.* they had obtained. We see relatively few groups of exotic objects and materials moving to and fro in Europe. On this basis, it has been called into question, whether social reproduction is likely to have come to depend on such exchange (Dietler 1998, 297; Kümmel 2001, 87–88). Under prehistoric conditions, interaction is contingent upon innumerable imponderabilities, and the consumption of foreign objects may have unintended consequences beyond the foresight of social actors (Dietler 2006, 229–30). Hence, there has to be positive evidence that it was possible to rely on outside contacts for the social reproduction of local systems – be it bulk trade or exchange in valuables. In prehistoric Europe, at least, this would seem a risky business (Dietler 1989, 132).

More importantly, however, the entire rationale underlying this argument may be misguided, if rather than (only) acquiring value in (asymmetrical) exchange, objects were (also) perceived as the material manifestation of traditional values and spiritual forces ‘given and manifestly inalienable’ (Barrett 2012, 14), and their circulation was not structuring the reproduction of political economy at all in the way we tend to expect (Barrett 2012, 12–15; Brück and Fontijn 2013, 201–4). Rather than projecting our own logic of exchange, value and human motivations onto the past, we may be well advised to consider an ancient reality in which these were firmly embedded within, and linked to, wider notions of

identity, the reproduction of community and cosmological order. That is to say, there may be good reasons to altogether abandon the model of prestige goods economy for large parts of prehistoric temperate Europe (Barrett 2012, 12, 14).

Conclusions

It is not argued here that the impact of interregional exchange on local systems is irrelevant. Yet, surely, in order to produce meaningful statements on past culture contact and interaction said impact has to be demonstrated rather than just assumed, and it is only one facet of a more complex ancient reality. Whether in a more traditional sense the economic impact of long-distance trade in metal and other commodities or instead the social dynamics of prestige goods exchange drawing on exotic objects are stressed, advocates of Neo-Diffusionism have us believe in social and cultural dynamics, and ultimately in convergence, as a consequence of contact and exchange. That is to say, they use the evidence of personal mobility and/or objects moving to and fro to bridge the gap between structurally different communities and societies, in our case between the Bronze Age Aegean or the wider eastern Mediterranean and the ‘Barbarian’ hinterland of prehistoric Europe. This approach has to be balanced by an awareness of the complex processes involved in the recontextualisation of exotic foreign objects. Particular attention must be paid to the ways these were actually drawn upon by social actors in specific local contexts.

Beyond local meanings and uses of foreign objects, however, the more general implication of this critique is that we are clearly entitled to assume long-term stability of local traditions and the continued co-existence of structurally different societies and cultures even if some kind of contact and/or exchange between them can be established (Barrett 2012, 15; Kienlin 2015a, 71–91). Often there is a misfit between the prehistoric situation under study and the ethnographic model applied. For example, the ‘tell societies’ referred to in this paper to any unbiased observer are characterised by long-term stability of place and architecture, gradual development of settlement layout and material culture only, and by conscious reference back to ancestral place. Yet in part of Bronze Age research these same communities are conceptualised in terms of rapid change, growth and ethnographically derived ‘prestige goods economies’, some of which, such as the *potlatch*, are quite uniquely competitive and the direct result of early modern colonial encounters between indigenous groups and the industrialised ‘West’.

Quite to the contrary, every occasional import find of Mycenaean origin which may come to light in Bronze Age groups to the north must not be used to overcome the fundamental divide that sets palatial society of the Aegean Bronze Age apart from such segmentary ‘tribal’ groups. Rather than being a weak reflection of palatial society,

and like the Mediterranean sequence itself, Bronze Age settlement in the Carpathian Basin is a complex and variable phenomenon – in chronological and regional terms as well as in socio-political and cultural ones. This tends to be ignored when likeness with Mediterranean development is expected and in the words of M. Dietler (1998, 297): ‘... otherwise sensible scholars [start] to see things that are not there and to ignore crucial developments ... in an effort to impose [*foreign*; *TLK*] structures ...’ Any perception of such long-lived settlement mounds in prehistoric ‘tribal’ communities which is solely derived from a narrow view of Mediterranean prototypes and has us focus on economic competition and/or political dominance is reductionist and misleading.

Both areas, the Mediterranean and ‘Barbarian’ Europe, feature complex societies and cultural complexity. Yet, it is only in the Mediterranean that with the Late Helladic Mycenaean palaces there is evidence of the emergence of politically differentiated societies (e.g. Galaty and Parkinson 2007; Shelmerdine and Bennet 2008; Schallin and Tournavistou 2015). Even in the Mediterranean, however, this development did not take the form of linear socio-political evolution from simple to most complex and hierarchically structured societies. Rather, starting with the Early Bronze Age corridor houses (e.g. Hägg and Konsola 1986; see for example the House of the Tiles at Lerna in the Argolid: Wiencke 2000), we witness the possibility of quite distinct forms of social and political complexity and historically specific notions of community and decision making (Peperaki 2004; 2010; Weiberg 2007; Pullen 2008; 2010; 2011). By contrast, the European sequence may expose more of a continuous development. Well into the Iron Age Europe may have seen ‘tribal cycling’ (cf. Parkinson 2002; 2006) rather than upward bound ‘social evolution’. In any case, there is no overarching pattern or logic of development that binds together both Bronze Age Europe and the Mediterranean. Approaches that have us believe so impoverish our understanding of prehistoric Europe, and ultimately of the Mediterranean too.

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Notes

- 1 E.g. Schauer (1984); Gerloff (1993; 2007; 2010); Hänsel (1998; 2002); Kristiansen (1998); Gebhard (1999); Kristiansen and Larsson (2005); Krause (2005; 2006–07); Gebhard *et al.* (2014); Suchowska-Ducke (2016); papers in Kolloquium Mainz (1990); Demakopoulou *et al.* (1999); Gancarski (2002); Meller (2004); Meller and Bertemes (2010); Bergerbrant and

- Sabatini (2013); archaeometallurgy: Roberts *et al.* (2009); Ling *et al.* (2013; 2014).
- 2 A classic example from the area under consideration is, of course, Spišský Štvrtok and the postulated Mycenaean origins of its stone-built fortification; see, for example, Vladár (1973, 273–93; 1975; 1977, 186). This is often quoted and the corresponding figures reproduced (e.g. Gogâltan 2010, 36–7, fig. 18; Suchowska-Ducke 2016, 72), of course, but the evidence is controversial and the wall may prove to be of Iron Age date (Jaeger 2014; 2016, 115–19; see also Alusik 2012, 13). Similarly, the often quoted rectangular ‘proto-urban’ layout of the Otomani-Füzesabony site of Košice-Barca is not well documented and probably the result of the combination of two distinct settlement phases in the published plan (Točík 1994; David 1998, 245–46).
- 3 Continued, for example, amongst many other papers in Kristiansen (2010; 2011) or Kristiansen and Suchowska-Ducke (2015). See also, of course, Kristiansen and Earle (2015) for a reply to and critique of my previous work and criticism of mainstream Bronze Age narratives (Kienlin 2012; 2015a; 2015b).
- 4 For a more balanced overview of Bronze Age Europe see, for example, Jockenhövel (1990), Harding (2000), Bartelheim (2007), Primas (2008), Bartelheim and Stäuble (2009) and Fokkens and Harding (2013). On the contradictory evidence of Mediterranean ‘import’ in southeastern Europe see also Schuster (2016).
- 5 See, for example, Vulpe (2001), Kiss (2011, 226; 2012), Fischl (2012, 46–7), Jaeger and Kulcsár (2013, 302–13), Fischl *et al.* (2013, 364) and Gogâltan (2015) on the absolute chronology of the Hungarian Early to Middle Bronze Age tell communities; the resulting problems with the notion of Mycenaean (even shaft grave period) ‘predecessors’ or ‘influence’ are obvious.
- 6 E.g. Chropovský and Herrmann (1982); Belardelli and Peroni (1996); Kristiansen (1998); Earle (2002); Gancarski (2002; 2006); Czebreszuk and Müller (2004); Kristiansen and Larsson (2005); Czebreszuk, Kadrow and Müller (2008); Earle and Kristiansen (2010); Müller, Czebreszuk and Kneisel (2010); Gogâltan (2010); Némethi and Molnár (2012); Jaeger, Czebreszuk and Fischl (2012).
- 7 For a critical review and assessment of this work, the problems it poses both on the empirical and theoretical side, see, for example, Harding (2006; 2013) and Nordquist and Whittaker (2007).
- 8 See also Kümmel (2001) and Harding (2013) for discussion of the problems of World System Theory in archaeology touched upon here.
- 9 E.g. Kristiansen (1987; 1994; 1998); Chase-Dunn and Hall (1991); Hall and Chase-Dunn (1993); Frank (1993); Sherratt (1993a; 1993b; 1994; 1997); Parkinson and Galaty (2009).
- 10 E.g. Rowlands (1987, 3, 11); Kohl (1987; 2011); Champion (1989, 14–15, 18); Sahlins (1994); Barrett (1998); Stein (1999a; 1999b; 2002; 2005a); Gosden (2001); Kümmel (2001); Dietler (2005; 2010); van Dommelen (2005; 2006; 2011); Galaty (2011); Harding (2013); Ulf (2014); Galaty, Tomas and Parkinson (2014).
- 11 E.g. Dietler (1989, 127–28, 134–36; 1998, 297–301; 2005, 61–67; 2006, 224–27; 2010, 50–53); Gosden (2001, 242–49);

- van Dommelen (2005, 116–18); Broodbank (2011, 28–29); Galaty, Tomas and Parkinson (2014, 158–62, 170–71).
- 12 E.g. Dietler (2005, 62–64; 2006, 225; 2010, 53); Greenberg (2011, 232–33); Bachhuber (2011, 164–71); Legarra Herrero (2011, 269–73); van Dommelen and Rowlands (2012, 21–27); Knapp (2012, 43–46).
 - 13 A prominent example is, of course, the work of M. Dietler (e.g. 1989; 1990; 1997; 1998; 2005; 2006; 2010) on Early Iron Age Europe and the Mediterranean.
 - 14 See, for example, papers in Meller (2004), Meller and Bertemes (2010) or Bergerbrant and Sabatini (2013). See also the debate on the controversial and possibly fake ‘Bronze Age’ import finds from Bernstorf (*pro*: Gebhard *et al.* 2014; Gebhard and Krause 2016; *contra*: Pernicka 2014a; 2014b).
 - 15 E.g. Sherratt (1993a); Kristiansen (1998); Kristiansen and Larsson (2005); O’Shea (2011); Kristiansen and Suchowska-Ducke (2015).
 - 16 See also Athanassov and Krauß (2015, 66–75) on the Late Bronze Age eastern Balkans’ situation, who note a distinct *Architekturgrenze* (and corresponding socio-political differences) between a rather narrow, southern (palatial/urban) Mycenaean zone and the northern (tribal) groups of ‘Barbarian’ Europe beyond.
 - 17 E.g. Wengrow (2009, 147–50) and Legarra Herrero (2011, 269–71); see also Maran (2013) on the Mycenaean appropriation of amber.
 - 18 Kristiansen and Suchowska-Ducke (2015) are mainly concerned here with a later, post-EBA tell culture horizon of Bronze Age ‘convergence’ (c. 1500–1100 BC), apparently reflecting growing awareness that the Early Bronze Age exposes less indications of Mediterranean ‘irradiation’ than later Bronze Age phases and predates Mycenaean ‘expansion’ anyway; the overall approach taken, however, is still that developed in the previous work of Kristiansen (e.g. 1998; 2011; Kristiansen and Larsson 2005).
 - 19 See the relevant volumes in the *Prähistorische Bronzefunde* (PBF) series (Schauer 1971; Krämer 1985; Kemenczei 1988; 1991; Bader 1991; Kilian-Dirlmeier 1993; v. Quillfeldt 1995), Harding (2007) and Athanassov and Krauß (2015, 64, 67–68).
 - 20 See Dietler (1998, 298) on the Iron Age situation: ‘... it is a serious analytical error to assume that asymmetrical relations or structures of power that ultimately appeared in later periods were necessarily a feature of the first stages of the encounter rather than a product of a subsequent complex history of interaction and entanglement.’ For sure, this also applies to earlier Bronze Age Europe, when evidence of contact and exchange with the Mediterranean is much weaker and even less likely to have been ‘systemic’ than during the Iron Ages. See also Dietler (1989, 130, 135; 1990, 357–58; 2005, 60–61), Kümmel (2001, 23, 87–88), Barrett and Damilati (2004, 150–62) and Barrett (2012, 8–15).
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Chapter 3

Metal artefacts circulation in the Eneolithic period from southeastern Romania. A case study

Catalin Lazar, Adelina Darie, Gheorghe Niculescu and Migdonia Georgescu

Introduction

Around 5000 BC, on the territory of northeastern Bulgaria and southeastern Romania, some major changes are visible in the people's way of life, including the rise of tell settlements, new building types (symmetrically organised within the settlement area), the development of settlement defence systems (ditches, banks and palisades) and the emergence of cemeteries outside settlements (Bailey 2000; Anthony 2010). This development is doubled by some changes in the economy marked by the adoption of new raw materials (*e.g.* copper, gold and graphite) coupled with the evolution of ceramic and lithic technologies, new ways of environmental exploitation and control, as well as the development of a complex and stratified society (Todorova 1986; Bailey 2000; Anthony 2010; Popovici 2010).

Based on the structural changes mentioned above and increasing the number of metal objects from southeastern Europe in the 5th millennium BC, many researchers referred to this last stage of Neolithic as the Copper Age, Eneolithic, or Chalcolithic (Todorova 1978; Dumitrescu *et al.* 1983; Lichardus 1991, *etc.*). In fact, that approach reflects the cultural-historical vision of prehistoric studies from targeted area, connected with questions of chronological methodology and terminology in order to define the archaeological cultures. These descriptions should be understood rather as chronological *termini tecnici*, or as a *historical epoch* (Schier 2014, 419). We will not insist on the limitations of this approach; a very good critical review has been presented recently by Schier (2014).

The substantial progress made by human communities in the 5th millennium BC, coupled with numerous metal artefacts discovered here, led some authors to discuss what they termed the *Ex Balcanae Lux* phenomenon (Todorova 1978; Sterud *et al.* 1984).

Starting from this complex situation, the aim of the current paper is to explore the Eneolithic metal artefacts discovered in the Sultana-Malu Rosu tell settlement in southeastern Romania that belongs to Kodjadermen-Gumelnita-Karanovo VI (KGK VI) dating to the second half of the 5th millennium BC. The analysis will explore the different aspects of gold and copper artefacts from this site, starting with technological and morphological characteristics, ending with symbolic meanings of these objects, and correlated with the compositional analysis performed on them. The aim of this integrative approach is to identify the regional exchange networks of metal artefacts in the northern Balkans, their social, ideological, symbolical and economical meanings, and assess how they reflect the individual and collective identities of the past people and communities.

Archaeological background

More than 6000 years ago, on the actual territory of Bulgaria and Romania a splendid civilisation was flourishing. It is known to the north of the Danube as Gumelnita (after the eponym settlement near Oltenita city) and to the south of the Danube, in Bulgaria, as Kodjadermen-Karanovo VI or Varna (in Black Sea area). Currently, most researchers accepted the name Kodjadermen-Gumelnita-Karanovo VI (KGK VI) for this cultural entity that occupied southeastern Romania, the southern part of the Republic of Moldova and the Ukraine, the eastern half of Bulgaria (on both sides of the Balkan Mountains) and extending south to the Aegean Sea (Todorova 1978; 1986; Dumitrescu *et al.* 1983; Petrescu-Dimbovita 2001; Popovici 2010; Lazar *et al.* 2016). The KGK VI dates in the second half of the 5th millennium BC and the beginning of the 4th millennium BC (*c.* 4550–3900 BC) as indicated by radiocarbon data (Table 3.2).

Generally, following the standard cultural-historical approach of prehistoric studies, archaeologists from Romania and Bulgaria consider that KGK VI originated from the evolution of previous cultures in Bulgaria and Romania (e.g. Boian, Maritsa, Polyanitsa, Karanovo V and Hamangia). This 'ideal picture' of past communities seems to be changed by new palaeogenetic analyses. Thus, based on the recent aDNA analysis it is known that these populations have a dominant NW Anatolian Neolithic-related ancestry along with some hunter-gather related ancestry, and sporadic evidence of steppe-related ancestry (2 individuals from Varna I and Smyadovo cemeteries) (Hervella *et al.* 2015; Mathieson *et al.* 2018).

Therefore, based on this new evidence it can be assumed that the arrival of a new population (at the very end of the 6th millennium BC and beginning of 5th millennium BC) led to the emergence of tell sites in the target area, which will become the characteristic form of habitation for over 1000 years.

More than 100 tell settlements are documented for southeastern Romania in the second half of 5th millennium BC (Dumitrescu *et al.* 1983; Bailey 2000; Petrescu-Dimbovită 2001; Anthony 2010; Brehard and Balasescu 2012). The development of that new kind of habitation was aided by a combination of water resources, forested foothills, arable land and raw material sources (Todorova 1986; Chapman 2010). Tell settlements had monumental visibility in the landscape. Buildings were symmetrically arranged within the settlement area and were in use for several hundred years (Dumitrescu *et al.* 1983; Bailey 2000; Chapman 2010). In addition, human communities living on tell sites placed cemeteries outside of the inhabited areas (Lazar 2011).

The tell sites contain an extensive material culture that reflects everyday activities (e.g. flint knapping, grinding, food preparation and storage) as well as sacred or ritual acts (e.g. clay figures, altars, sacrificial burials, isolated human skulls and painted wall plaster) (Chapman 2010; Popovici 2010; Lazar 2012). Tell sites also exhibit changes in palaeo-economic strategies and animal exploitation (Brehard and Balasescu 2012).

In the material culture body of tell settlements in southeastern Romania the metal items occupied an important position, and they seem to emphasize structural changes in human society from the 5th millennium BC onwards (Table 3.1; Figure 3.1/Colour Figure 3.1). The artefacts made from these raw materials (copper and gold) are not very numerous in the KGK VI sites from the target area; metal items are attested in fewer than 50 tell sites and their absolute time span lay between 4600–3900 cal BC. An exception is represented by the large quantities of metal objects discovered at Pietrele tell settlement (almost 300 metal pieces) (Berciu 1956; Hansen 2015), which represents a much larger quantity than was found in all other settlements and cemeteries in south-east Romania.

In most cases, unfortunately, metal artefact quantity is very low. The copper objects are dominant (Table 3.1), primarily in the form of axes, awls, rings, pins and needles as is shown by the discoveries from Bucsani-La Pod, Cascioarele-Ostrovel, Gumelnita, Harsova, Luncavita, Mariuta, Pietrele, Sultana-Malu Rosu, Varasti, Vidra, and Vitanesti tell sites (Galbenu 1962; Dumitrescu 1965; 1966; Comsa 1978a; 1978b; Comsa and Ionescu 1979; Bem 2000; 2001; Nica and Fantaneanu 2000; Mares 2002; Micu and Belc 2005; Hansen *et al.* 2008; 2010; Andreescu *et al.* 2009; Toderas *et al.* 2009; Serbanescu 2013; Simon 2014; Darie 2015). The copper ornaments are rings or bracelets and are very rare in KGK VI sites from Romania (e.g. Cascioarele-Ostrovel, Chitila, Geangoiești, Glina, Gumelnița, Harsova, Pietrele) (Nestor 1928; Berciu 1956; Dumitrescu, 1966; Vulpe 1973; Comşa 1978a; Bem 2000; Ilie 2010). Furthermore, anthropomorphic bone figurines with copper ornaments are mentioned from some sites (e.g. Căscioarele-Ostrovel, Glina, Mariuta, Pietrele, Sultana-Malu Rosu or Vidra) (Rosetti 1939; Comşa 1978a; Andreescu 2002; Toderas *et al.* 2009). In the present study, so-called copper beads documented in certain sites are not included (Darie 2015) because they are made of malachite, not copper (Lazar 2012).

On the other hand, the situation is similar for the gold items from KGK VI sites in Romania (Table 3.1). Thus, only 12 discoveries of this kind are attested in sites from Balaci, Bucsani-La Pod, Chirnogi II, Chirnogi IV, Gumelnita, Morteni, Pietrele, Sultana-Malu Rosu, Varasti, Vidra, Vitanesti, and Vladiceasca (Comsa 1974a; Halcescu 1995; Bem 2001; Andreescu *et al.* 2009; Toderas *et al.* 2009; Serbanescu 2013).

Finally, it should be noted that copper and gold items are missing from most of the funerary complexes documented in southeastern Romania (Table 3.1). This kind of context is attested only in a few cases: a grave from Chirnogi II cemetery (five small tubular beads made of gold); an isolated grave from Chirnogi IV (a gold tubular bead); an isolated grave from Curcani (rectangular copper chisel); grave no. 5 from Chitila tell (copper bracelet); grave no. 1 from Gumelnita cemetery (copper axe and chisel; grave no. 4 from Mariuta cemetery (copper awl); the graves 58 (three golden cylindrical beads and a small gold earring) and 100 (a tubular gold bead and a gold circular pendant) from Varasti cemetery (Comsa 1995; Lazar 2001; 2012; Cojocaru and Serbanescu 2002; Lazar *et al.* 2011). This situation represents a strong contrast compared to the that in Bulgaria where the KGK VI cemetery from Varna I contained massive concentrations of copper and gold items (Todorova 1971; 2002; Slavchev 2010). A different situation is shown in the Durankulak and Devnja cemeteries where small quantities of gold ornaments such as beads, rings, earrings were identified. For example, approximately 13 graves from the Durankulak necropolis

Table 3.1 The KGK VI sites from southeastern Romania that contain the metal artefacts

Site	Type*	Copper	Gold	References
Balaci	TS		•	Ilie <i>et al.</i> 2015
Bratesti	IF	•		Mares 2002
Bucsan-La Pod	TS	•	•	Bem 2001
Cascioarele-Ostrovel	TS	•		Dumitrescu 1965; Comsa 1978a; Bem 2000
Cernavoda	TS	•		Comsa 1978a
Chiraftei	IF	•		Comsa 1978a; Mares 2002
Chirnogi II	C		•	Lazar 2012
Chirnogi IV	IG		•	Cojocaru and Serbanescu 2002
Chitila	TS	•		Mares 2002; Lazar 2012
Ciolanestii din Deal	TS	•		Comsa 1978a; Mares 2002
Coteana	IF	•		Comsa 1978a; Mares 2002
Cunesti	TS	•		Comsa 1978a; Mares 2002
Curcani	IG	•		Lazar 2012
Draganesti-Olt	TS	•		Nica and Fantaneanu 2000
Gărgău	IF	•		Bem 2000; Mares 2002;
Geangoiesti	TS	•		Ilie 2010
Glina	TS	•		Comsa 1978a; Mares 2002
Gumelnita	TS	•	•	Dumitrescu 1966; Comsa and Ionescu 1979
Gumelnita	C	•		Lazar 2001
Harsova	TS	•		Galbenu 1962; Comsa 1978a; Mares 2002
Iepuresti	FS	•		Schuster <i>et al.</i> 2010
Însuratei	TS	•		Mares 2002
Jilava	TS	•		Bem 2000; Mares 2002
Liscoteanca	TS	•		Comsa 1993; Mares 2002
Luica	FS	•		Comsa 1978a; Mares 2002
Luncavita	TS	•		Micu and Belc 2005
Mariuta	TS	•		Simon 2014
Mariuta	C	•		Lazar <i>et al.</i> 2011
Mavrodin	FS	•		Unpublished
Morteni	TS	•	•	Mares 2002; Ilie <i>et al.</i> 2015
Navodari	TS	•		Mares 2002
Petru Rares	TS	•		Comsa 1978a; Mares 2002
Pietrele	TS	•	•	Hansen <i>et al.</i> 2008; 2010; Toderas <i>et al.</i> 2009
Pietrele	C	•		Hansen <i>et al.</i> 2012
Poroschia	TS	•		Comsa 1978a; Mares 2002
Prundu	FS	•		Comsa 1978a; Mares 2002
Radovanu	TS	•		Comsa 1974b; Mares 2002
Sarulesti	TS	•		Comsa 1978a; Mares 2002
Seinoiu	TS	•		Şimon 2014
Silistea-Gumesti	TS	•		Comsa 1978a; Mares 2002
Slatina	TS	•		Stefan 2014

Table 3.1 The KGK VI sites from southeastern Romania that contain the metal artefacts (Continued)

Site	Type*	Copper	Gold	References
Sultana-Malu Rosu	TS	•	•	Isacescu 1984; Hălcescu 1995; Andreescu <i>et al.</i> 2011
Tangaru	TS	•		Mares 2002
Teiu	TS	•		Comsa 1978a; Mares 2002
Vărăști	TS	•	•	Comsa 1978b; Mares 2002
Vărăști	C		•	Comsa 1995; Lazar 2012
Vânătorii Mici	TS	•		Mares 2002
Vidra	TS	•	•	Comsa 1978a; Mares 2002
Vitanesti	TS	•	•	Mares 2002; Andreescu <i>et al.</i> 2009
Vladiceasca	TS	•	•	Serbanescu 2013
Ziduri	TS	•		Cristoceca and Mandescu 2002

* C = cemetery; FS = flat settlement; IF = isolated finding; IG = isolated grave; TS = tell settlement.

and a few graves from Devnja contained gold finds (Todorova 1971; 1986; 2002).

Sultana-Malu Roșu tell settlement: A case study

The site of Sultana-Malu Rosu is located in SW Romania, about 7 km north of the Danube River, near the border with Bulgaria (Figure 3.1/Colour Figure 3.1). The research started in 1923 and continued (with some breaks) to the present. The site consists of a tell settlement (KGK VI), a flat settlement (Boian culture) and a common cemetery used by both communities (Lazar 2014; Lazar *et al.* 2016). The tell settlement is placed on the western high terrace of the Lake Mostistea, with corresponding absolute altitude of 42.005 and 46.280 m asl. Unfortunately, in the last 90 years most of the settlement has eroded into Lake Mostistea. Today only a part of the 1544 m² area is preserved. The shape of the settlement was oval, oriented northeast–southwest (Figure 3.2) (Lazar *et al.* 2016). The absolute time span of the tell settlement was 4538–3961 cal BC (Table 3.2).

Until now, the metal artefacts have only been found in the tell settlement. The first three copper items were discovered in 1923 (Andriescu 1924). Unfortunately, the data about these pieces are minimal and they were lost during the Second World War. Therefore, they are not included in our analysis.

The metal items batch from Sultana-Malu Rosu consists in total of 11 copper items plus seven gold ornaments (Isacescu 1984; Hălcescu 1995; Andreescu *et al.* 2011). Only three copper items (ID 8, 9, 10) and one gold pendant (ID 7) are from our excavations. The rest coming from excavations undertaken in the 1970s and 1980s (Table 3.3). The morphological and typological features of these metal artefacts are typical for KGK VI communities.

The copper items consist of six awls (five complete specimens – ID 1, 4, 10, and 11), and a complete chisel (ID 7)

(Figure 3.3/Colour Figure 3.3). From the morphological point of view, the copper awls present rectangular cross-section for the proximal end and circular for the distal end (ID 2, 3, 5, and 6), circular section in the closer part (ID 1 and 4). The majority of these finds are bent in distinct parts, in the middle (ID 1 and 2), or toward the end (ID 4). Also, the objects present advanced traces of oxidation, except the specimen labelled ID 4. The preserved lengths range between 5.00 cm and 14.55 cm, and weigh between 2.22 g and 11.12 g (Table 3.3). A notable discovery is that of a completely preserved copper chisel (ID 7), with rectangular cross-section and traces of use on both ends. The finds context data are available for seven specimens (Table 3.3). Most of the copper items were found in houses (ID 5, 6, 8, 9 and 10) or in the proximity of them (ID 1 and 7) (Figure 3.2). The compositional analysis made on those items indicates that they are manufactured from native copper with a purity ratio of 88.38% and 100% (Table 3.4). This may indicate the use of arsenical ore. The observed differences are due to the fact that the measurements were performed on the surface of corroded objects; the corrosion crust includes soil products that formed during the oxidation process.

There are 7 gold items from Sultana Malu Rosu (Table 3.3; Figure 3.4/Colour Figure 3.4). The first was found in 1982: a gold assemblage (ID 1–6), weighing a 37.17 g. It is the largest discovery of its kind from Romanian Eneolithic contexts (Figure 3.4) and led to the naming of it as the ‘Hoard of Sultana’ (Hălcescu 1995; Andreescu *et al.* 2011). The hoard comprises 4 circular pendants, a necklace with 7 links and 4 *saltaleone* (Table 3.3; Figure 3.4). It was identified in a dwelling, on the hearth, in association with fragments belonging to a miniaturized house representation. In 2003, during new excavations in house L2, inside the heart structure (among its rebuilding layers), a small pendant made of golden foil, in a flat tubular shape and perforated was found (Andreescu *et al.* 2011; Lazar *et al.* 2016). The

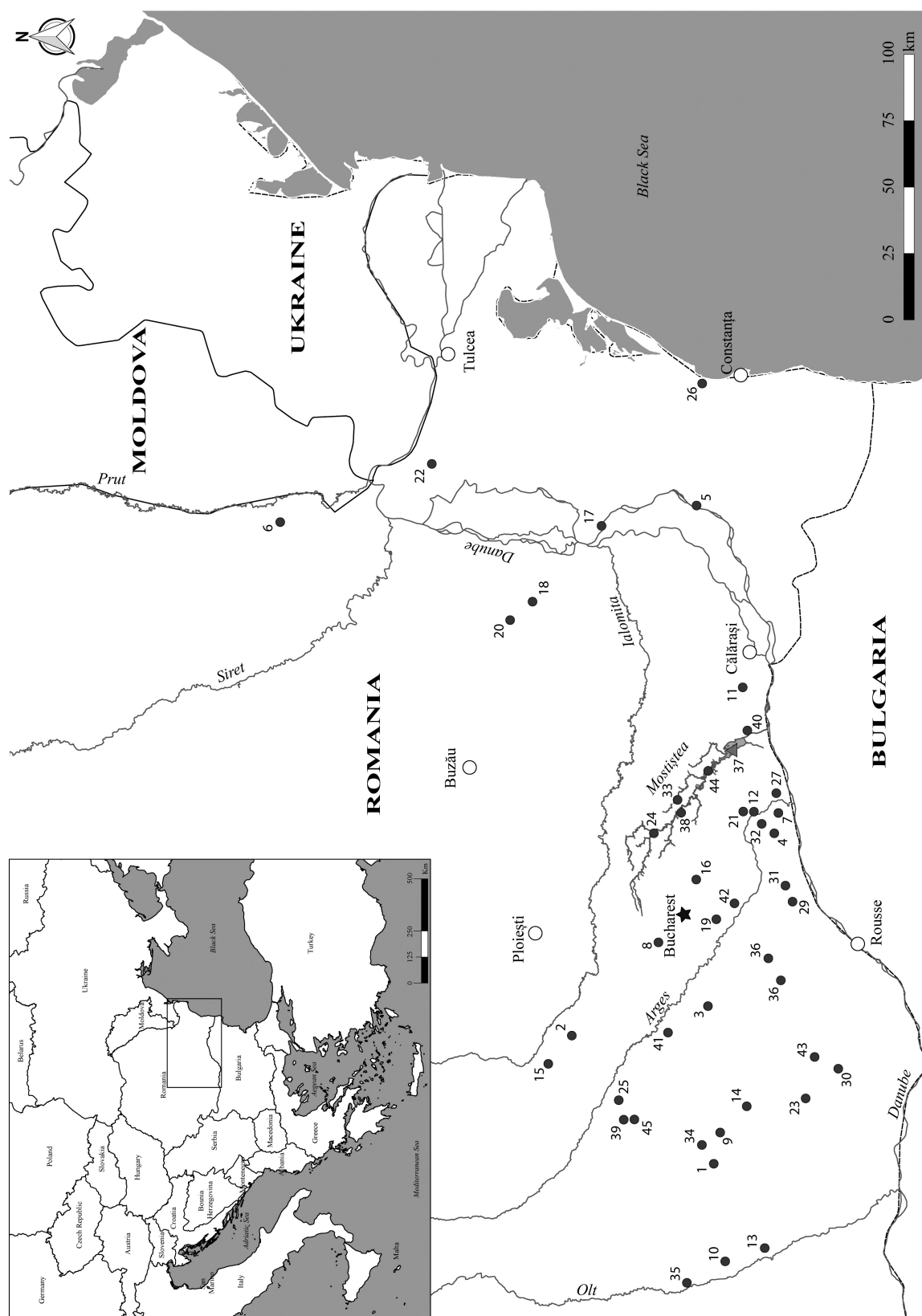


Figure 3.1 Map of the KGK VI sites from southeastern Romania that contain metal artefacts: 1. Balaci; 2. Bratești; 3. Bucșani; 4. Cascioarele-Ostrovel; 5. Cernavoda; 6. Chiraftei; 7. Chimogji II; 8. Chitila; 9. Ciolaneștii din Deal; 10. Coteana; 11. Cunești; 12. Curcani; 13. Draganești-Olt; 14. Garagau; 15. Geangoiești; 16. Glină; 17. Harsova; 18. Insuratei; 19. Jilava; 20. Liscoleanca; 21. Lulca; 22. Luncavita; 23. Mavrodin; 24. Mariuta; 25. Morteni; 26. Navodari; 27. Oltenița-Gumești; 28. Petru Rareș; 29. Pietrele; 30. Poroschia; 31. Prundui; 32. Radovanu; 33. Sarulești; 34. Slatina; 35. Slatina-Gumești; 36. Tangaru; 37. Sultana-Malu Rosu; 38. Seinoiu; 39. Teiu; 40. Vârști; 41. Văntorii Mici; 42. Vidra; 43. Vitanesti; 44. Vlădiceasca; 45. Ziduri

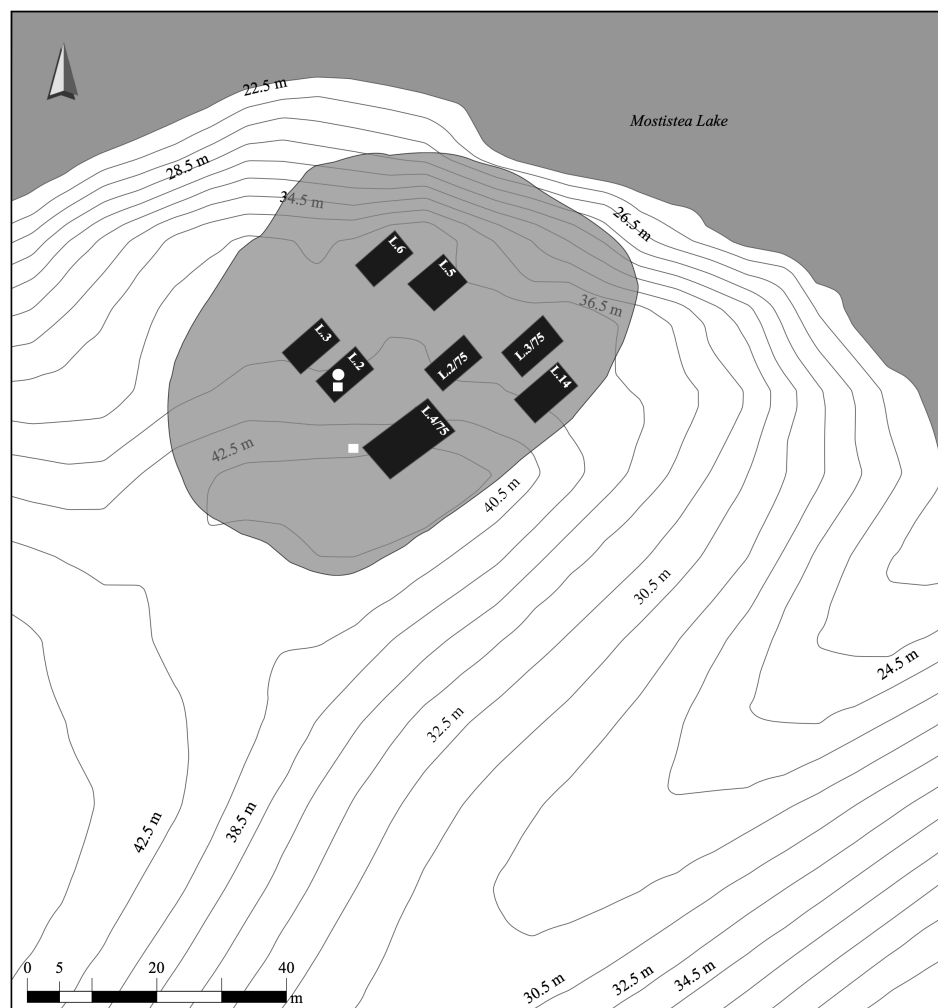


Figure 3.2 The tell settlement of Sultana-Malu Rosu and the distribution of the KGK VI houses. The circles mark gold findings and rectangles copper findings for which the context data are available

new compositional analyses made on those items has been indicating a similar composition (Table 3.5), with more than 90 wt% gold concentration and silver content between 4.93 wt% and 9.52 wt%. An exception is the smallest piece of *saltaleone* (Table 3.5), that presents an 86.55 wt% gold concentration, and 13.33 wt% silver content. The data obtained by us are very similar to those of previous analyses (Cojocaru and Serbanescu 2002).

Discussion

From the typological point of view, the variability of the metal items from Sultana-Malu Rosu is not high; only two copper and three gold distinct typological categories were discovered. We distinguished ten copper awls with different morphological variations, one copper chisel, four gold pendants, four *saltaleone*, part of the same artefact and seven links, composing one necklace.

The copper awls from our site are similar to other artefacts from this kind identified in the area of KGK VI from Romania and Bulgaria, as is shown by the findings from Cascioarele-Ostrovel, Durankulak, Goljamo Delcevo, Gumelnita, Harsova, Mariuta, Pietrele, Ruse, Varasti, Varna I, Vladiceasca, *etc.* (Comsa 1978a; 1978b; Comsa and Ionescu 1979; Todorova 1986; 2002; Bem 2000; Todorova and Vajsov 2001; Serbanescu 2013; Simon 2014; Hansen 2015). The copper chisel (ID 7) has good analogues in cemeteries from Durankulak, Gumelnita and Varna I (Lazar 2001; Todorova 2002; Slavchev 2010). The 'Hoard of Sultana' is very similar with the hoard found in house no. 4 from Hotnitsa tell settlement that consists of 40 links and 4 circular pendants (Angelov 1959). Several circular pendants with some morphological variation are well known in the settlements and cemeteries of KGK VI communities (*e.g.* Debar, Durankulak, Gumelnita, Kosharic, Pietrele, Polianovo, Radingrad, Ruse, Sava, Sofronievo, Varasti, Varna I, Vidra,

Table 3.2 Summary of ^{14}C radiocarbon dates related to KGK VI sites that contain the metal artefacts from southeastern Romania. The calibration of the radiocarbon dates was made with OxCal v4.2 (Bronk Ramsey 2009). Calibration with 2σ confidence is based on the IntCal13 dataset (Reimer *et al.* 2013)

Site	Type*	^{14}C determination BP	2σ calibrated BC	References
Cascioarele-Ostrovel	TS	5450±35	4353–4246	Unpublished
Cascioarele-Ostrovel	TS	5400±120	4458–3975	Laszlo 1997
Cunesti	TS	5660±40	4592–4370	Lazar <i>et al.</i> 2013
Gumelnita	TS	5400±90	4446–3997	Laszlo 1997
Gumelnita	TS	5495±35	4448–4263	Unpublished
Gumelnita	C	5625±35	4527–4365	Unpublished
Harsova	TS	5575±65	4546–4274	Brehard and Balasescu 2012
Harsova	TS	5304±51	4315–3992	Brehard and Balasescu 2012
Luncavita	TS	5425±40	4353–4173	Brehard and Balasescu 2012
Mariuta	TS	5385±42	4337–4062	Unpublished
Mariuta	C	5560±40	4462–4338	Unpublished
Mariuta	C	5440±40	4358–4233	Unpublished
Pietrele	TS	5602±47	4523–4350	Reingruber and Thissen 2009
Pietrele	TS	5539±43	4460–4330	Reingruber and Thissen 2009
Pietrele	TS	5424±33	4344–4235	Reingruber and Thissen 2009
Pietrele	TS	5366±34	4329–4058	Reingruber and Thissen 2009
Seinoiu	TS	5470±40	4442–4240	Unpublished
Sultana-Malu Rosu	TS	5250±40	4230–3973	Lazar <i>et al.</i> 2016
Sultana-Malu Rosu	TS	5230±50	4174–3961	Lazar <i>et al.</i> 2016
Sultana-Malu Rosu	TS	5630±40	4538–4365	Lazar <i>et al.</i> 2016
Sultana-Malu Rosu	TS	5570±40	4486–4342	Lazar <i>et al.</i> 2016
Sultana-Malu Rosu	C	5507±55	4458–4258	Hervella <i>et al.</i> 2015
Sultana-Malu Rosu	C	5680±35	4614–4406	Unpublished
Varasti	TS	5360±70	4341–4005	Laszlo 1997
Varasti	C	5525±35	4451–4331	Unpublished
Vitanesti	TS	5379±27	4331–4075	Brehard and Balasescu 2012
Vitanesti	TS	5430±40	4354–4177	Brehard and Balasescu 2012
Vitanesti	TS	5400±40	4344–4072	Brehard and Balasescu 2012
Vladiceasca	TS	5700±40	4679–4456	Unpublished
Vladiceasca	TS	5625±30	4522–4367	Unpublished
Vladiceasca	TS	5610±30	4498–4361	Unpublished

* C = cemetery; TS = tell settlement

etc.) (Angelov 1957; Ivanov 1978; Comsa 1995; Bailey 2000; Todorova and Vajsov 2001; Todorova 2002; Slavchev 2010; Hansen 2015). On the other hand, it is very interesting that similarly shaped circular pendants made from clay or bone are attested in some sites (*e.g.* Drama, Goljamo Delcevo, Pietrele, Ruse, *etc.*) (Todorova and Vajsov 2001; Hansen *et al.* 2011). Necklaces composed by links or saltaleoni are documented at Telish settlement and Varna I cemetery (Ivanov 1978; Todorova and Vajsov 2001; Slavchev 2010).

Most authors sustain the idea of an autochthonous innovation and evolution of metallurgy in the Balkans (Boric 2009; Anthony 2010; Pernicka and Anthony 2010; Radivojevic 2015a; 2015b, 2017) with various relevant arguments. However, it is impossible to ignore the fact that the emergence of metallurgy here corresponds with the appearance of new population in the region with an Anatolian Neolithic-related ancestry (Hervella *et al.* 2015; Mathieson *et al.* 2018). This situation requires consideration of other

Table 3.3 The contextual and typological data of the metal items from Sultana-Malu Rosu tell settlement

ID	Type	Year	Context	Height (cm)	Thickness (cm)	Diameter (cm)	Weight (g)	Reference
<i>Copper</i>								
1	Awl	1975	Outside of house L4/1975	7.71	0.42		5.00	Unpublished
2	Awl	1975	?	9.59	0.42		8.00	Unpublished
3	Awl	?	?	5.08	0.21		3.00	Unpublished
4	Awl	?	?	14.55	0.26		7.00	Unpublished
5	Awl	1983	House L1/1983	5.20	0.40		9.00	Isacescu 1984
6	Awl	1983	House L1/1983	5.00	0.60		3.00	Unpublished
7	Chisel	1983	Ash layer	15.90	0.80		114.00	Unpublished
8	Awl	2003	House L2	5.33	0.33		2.22	Unpublished
9	Awl	2003	House L2	6.20	0.32		2.73	Unpublished
10	Awl	2003	House L2	11.31	0.41		11.12	Unpublished
11	Awl	1982	?	11.01	0.61		?	Isacescu 1984
<i>Gold</i>								
1	Circular pendant	1982	Heart of a house	5.50	0.02	4.36	9.48	Halcescu 1995
2	Circular pendant	1982	Heart of a house	4.02	0.03	3.89	10.25	Halcescu 1995
3	Circular pendant	1982	Heart of a house	1.44	0.04	1.44	0.45	Halcescu 1995
4	Circular pendant	1982	Heart of a house	2.18	0.05	2.69	2.60	Halcescu 1995
5	Necklace with 7 links	1982	Heart of a house	7.12	0.08	1.09	5.32	Halcescu 1995
6	Necklace with 4 saltaleone	1982	Heart of a house	3.70–6.90	1.80	1.80–1.90	7.35	Halcescu 1995
7	Pendant	2003	House L2	2.3	0.03	1.79	0.40	Andreescu <i>et al.</i> 2011

scenarios regarding the innovation and development of metallurgy in the Balkans. Certainly, this *population input* can explain different cultural changes and technological innovations, alongside with the strengthening and extension of the previous exchange networks. It is clear for everybody that copper and gold objects did not belong to the initial Neolithic package (Hansen 2011) of the first population that arrived in southeastern Europe. The use of these new raw materials alongside others (*e.g.* graphite) is connected to a complex phenomenon that begins in the 5th millennium and involved fundamental changes in the socio-economical way of life (Bailey 2000; Anthony 2010; Brehard and Balasescu 2012).

On the other hand, it is obvious that the metals were not available everywhere in southeastern Europe and prehistoric people had to transport these raw materials over large distances. The geological characteristics of southeastern Romania indicate the absence metal-ore deposits, with exception of the copper source from Altân Tepe (Tulcea county) that contain different minerals (*e.g.* native copper, azurite, chalcopryrite, cuprite, malachite, bornite, calcozine, and chalcantite) (Danila and Danila 1982). However, the compositional analyses performed on the copper objects from

different KGK VI sites in Romania (Harsova, Luncavita, Pietrele, Sultana-Malu Rosu, and Vidra) (Junghans *et al.* 1968; Micu 2005; Hansen *et al.* 2008) indicated multiple similarities between these items and those discovered in northeastern Bulgaria. Moreover, the investigations from the last 30 years indicate the existence and exploitation of copper sources by prehistoric communities in the central Balkans (*e.g.* Rudna Glava and Majdenpek), but also in the eastern Balkans (*e.g.* Ai Bunar, Čelopeč, Burgas-Strandža) (Cernyh 1988; Jovanovic 2009; Leusch *et al.* 2015). This assertion is sustained by a group of 80 analyses performed on the copper objects from Pietrele tell settlement, which led to the conclusion that ore deposits from Serbia and Bulgaria could have been the sources of the raw copper used here (Hansen *et al.* 2008).

In these circumstances it is clear that copper reaches the KGK VI sites in Romania on the exchange routes created by prehistoric communities since the beginning of the Early Neolithic (maintained and further developed) for other prestigious goods (*e.g.* *Spondylus*, flint, malachite, graphite, *etc.*). Moreover, a recent study (Radivojevic and Grujic 2018) regarding patterns of copper supply among prehistoric

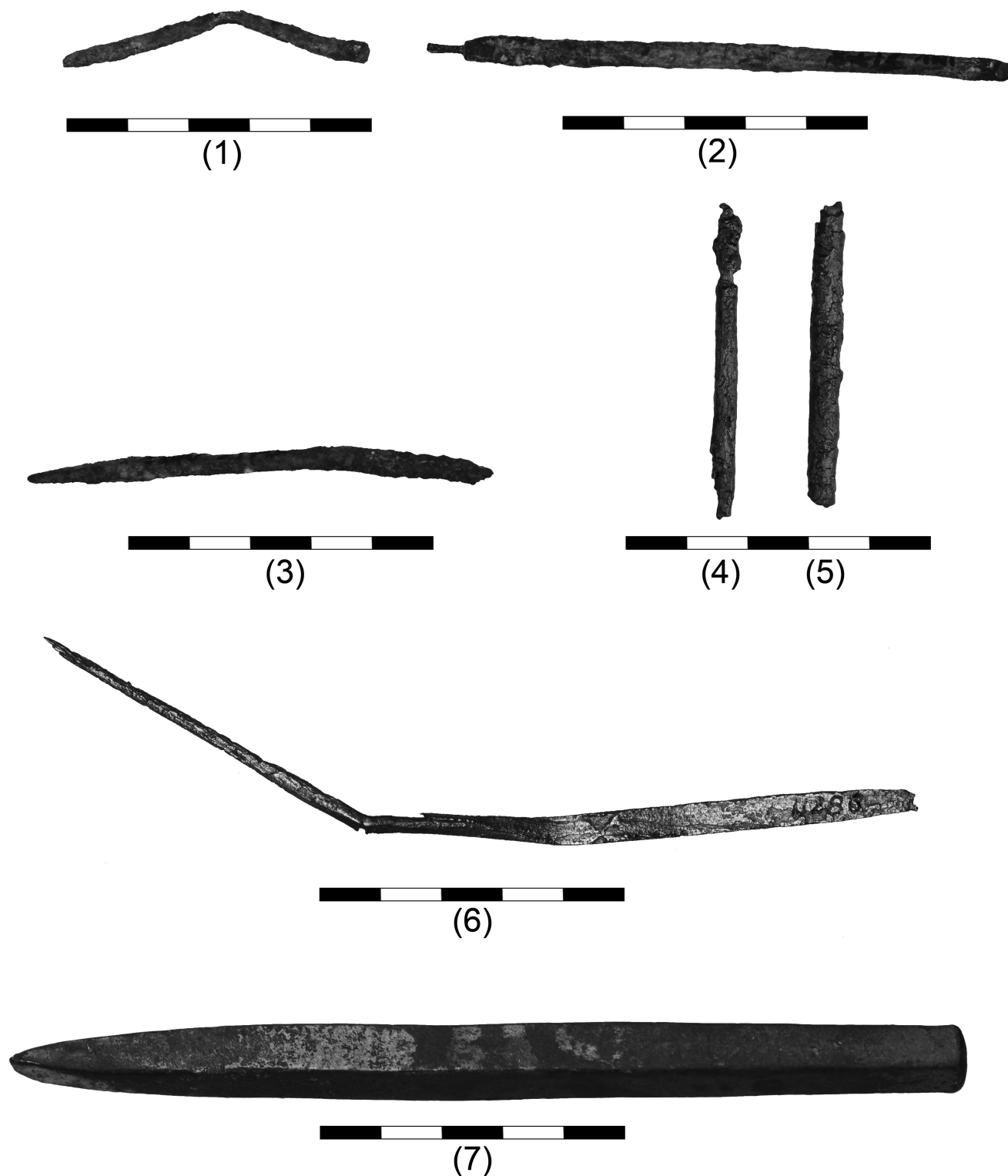


Figure 3.3 The copper items from Sultana-Malu Rosu tell settlement (ID 1–7): copper awls (1, 2, 3, 6); fragments (4, 5); chisel (7) (photo: T. Ignat)

Table 3.4 Element concentrations identified on the surface of the copper artefacts from Sultana-Malu Rosu. The analyses were done with a handheld XRF spectrometer type InnovX Systems Alpha Series with an X-ray tube provided with Tungsten anode, SiPin diode detector, 40 kV, 35 microA, acquisition time 60 s

ID	Item		Elements (wt %)								
	Type	Area	Ti	Fe	Cu	Zr	Zn	As	Pb	Bi	Ag
1	Awl	Proximal		0.22	99.78						
2	Awl	Proximal	0.41	3.92	95.53	0.14					
		Distal			100.00			0.001			0.001
3	Awl	Proximal	0.24	2.04	97.67	0.05					0.001
4	Awl	Proximal	1.52	0.43	98.04						
		Distal			100.00						0.001
5	Awl	Distal	0.83	10.35	88.38	0.43		0.001	0.001	0.001	
6		Distal	0.91	9.37	89.29	0.42		0.001	0.001	0.001	
7	Chisel	Distal		0.001	99.76			0.24			
		Proximal		0.06	99.64			0.30			
8	Awl	Proximal		0.001	100.00						0.001
9	Awl	Proximal		0.001	100.00						0.001
10	Awl	Proximal	0.22	1.68	98.07	0.02		0.001	0.001		

societies indicate the existence of complex copper exploitation and distribution networks in the Balkans that started around 6200 BC and evolved until 3200 BC. Unfortunately, this study does not include the prehistoric sites from Romania and does not allow us to make finer observations about our target area.

Another important question is whether copper arrived as ore, as raw copper (e.g. ingots) or as finished goods in these sites. Some authors, starting from the discovery of clay or stone moulds in few tell settlements from Romania (Cascioarele-Ostrovel and Vidra), or some copper drops (Vidra), objects linked to smelting activities (Geangoesti), and a copper bullion (Vitanesti), hypothesised that there existed local copper processing centres (Comsa 1978a; Dumitrescu *et al.* 1983; Ilie and Neaga 2010). However, this hypothesis cannot be sustained, primarily due to the isolated nature of these discoveries, but also because until now there have not been identified suitable furnaces for practising metallurgy in KGK VI contexts in Romania. On the other hand, in most KGK VI settlements the quantity of copper pieces is very low (Table 3.1). An exception to this observation is the tell settlement from Pietrele where 293 copper items are documented (Hansen 2015), though the other elements that define a local metallurgical centre are missing (Toderas *et al.* 2009). This massive concentration of copper items in Pietrele could be linked to the important geographical position of the settlement in the exchange network in the Balkans, but also its particular status as consumption and distribution centre in the region. This assumption is supported by the presence in this tell settlement of large quantities of other categories of prestigious goods

(e.g. flint super-blades and axes, shell ornaments, graphite pottery, *etc.*) made from raw materials that do not have a local origin (Hansen *et al.* 2008; 2010; 2011; 2012; Toderas *et al.* 2009; Hansen 2015). On the other hand, the situation from Pietrele site reflects other complex phenomena as the emergence of elites, the wealth accumulation process, and the development of stratified societies in KGK VI societies.

Regarding the KGK VI gold items discovered in Bulgaria and Romania, the compositional analyses performed on the artefacts from different sites (e.g. Balaci, Chirnogi II, Chirnogi IV, Durankulak, Gumelnita, Hotnitsa, Morteni, Sultana-Malu Rosu, Vitanesti, Vladiceasca) (Cojocaru and Serbanescu 2002; Todorova 2002; Andreescu *et al.* 2009; Ilie *et al.* 2015; Leusch *et al.* 2015) indicate that the past communities used alluvial gold. Evidence for local gold manufacturing centres in Romania are not available. The gold artefacts from the KGK VI sites in Romania are most linked to exchange networks and were acquired by those communities as finished goods. Apparently, the KGK VI gold artefacts from Bulgaria and Romania are made from different gold sources (Slavchev 2010; Ilie *et al.* 2015; Leusch *et al.* 2015) that can be located in eastern Bulgaria, as well as rivers in Romania (Bem 2002; Bugoi *et al.* 2003; Ilie *et al.* 2015). It is that gold was not only used for making artefacts, but also for painting pottery decorations as demonstrated by the discoveries from Varna I cemetery or Vitanesti tell settlement (Andreescu *et al.* 2009; Slavchev 2010). Moreover, some pottery fragments from Bucsani tell settlements contain sandy gold in paste (Bem 2002). All these indicate the multiple application of this precious metal.



Figure 3.4 The gold items from Sultana-Malu Rosu tell settlement (ID 1–6)

Table 3.5 Element concentrations identified on the surface of the gold artefacts from Sultana-Malu Rosu. The analyses were done with a handheld XRF spectrometer type InnovX Systems Alpha Series with an X-ray tube provided with Tungsten anode SiPin diode detector, 40 kV, 35 microA, acquisition time 120 s

ID	Item		Elements (wt %)					
	Type	Area	Fe	Ni	Cu	Au	Pb	Ag
1	Circular pendant	Proximal	0.001	0.001	0.001	91.06		8.94
2	Circular pendant	Proximal	0.04	0.001	0.001	92.35		7.60
3	Circular pendant	Proximal	0.001	0.001	0.001	91.40		8.60
4	Circular pendant	Proximal	0.14	0.001	0.001	92.60	1.17	6.08
5	Necklace with 7 links	Distal	0.12	0.001	0.001	92.20	0.23	7.45
6	Necklace with 4 saltaleone-largest piece	Distal	0.001	0.001	0.001	91.97		8.03
	Necklace with 4 saltaleone-second largest piece	Distal	0.16	0.001	0.001	90.32		9.52
	Necklace with 4 saltaleone-smallest piece	Proximal	0.12	0.001	0.001	86.55		13.33
7	Pendant	Proximal	0.86	0.04	0.001	94.17		4.93

Conclusions

In sum, our survey on copper and gold artefacts in 5th millennium BC of southeastern Romania indicate the importance of those raw materials in the Eneolithic period as well as complex interactions between these metals and the past communities that used them. The situation is quite different from what happens in northeastern Bulgaria, in the KGK VI communities that are contemporary with those from southeastern Romania. Thus, there is visibly high accumulation of metal items in certain cemeteries (e.g. Varna I, Durankulak, Devnja), located mainly on the western coast of the Black Sea, which is not documented in the KGK VI funerary areas of Romania. Certainly, what happens in the seaside is related to the exchange networks, but also with the emergence of the elites in the KGK VI societies. However, a special case in the target area is represented by the tell settlement from Pietrele (Hansen *et al.* 2008; 2010; 2011; 2012) where a large accumulation of copper objects is attested. Thus, this situation may reflect an important role for that settlement as a centre of consumption, distribution (and production?) that likely related to its key-position in the exchange networks from the Balkans. In case of the other 5th millennium BC sites of southeastern Romania, there is a paucity of metal artefacts that indicate the regular status of those communities, as well as some differences between settlements with respect to their regional importance and wealth accumulation processes.

The analysis of the metal artefacts from Sultana-Malu Rosu complete the data available for early metallurgy in the Balkans and it has provided an interesting evidence concerning the individual and collective choices of that human community. Undoubtedly, these pieces reflect a form of symbolic expression of those communities, related to the construction of identities and personhood, but also to the emergence of elites and the development of some socio-

economic differences in KGK VI societies. The metal items reflect the existence of a dominant ideology in the second half of the 5th millennium BC that is probably bound by the development of exchange networks with the distribution of copper and gold in southeastern Europe.

The issue of metal items from prehistoric communities is a interesting one, because those artefacts reflect the relation between the people, who collected the metals, manufactured the items, transported, traded, used, inherited, sacrificed and abandoned them. Furthermore, the artefacts manufactured in copper and gold depicted a kind of shared identity between distant geographic areas, but also a form of connection of the people in these regions. Without doubt, the metal items can be considered as active agents of social structures, mentalities, ideologies, ideas, beliefs and the organizing principles of the peoples who manipulated, used and desired them. On the other hand, the process of transformation of native metals into tools or ornaments change their meaning from natural elements to material culture, associated with people and their identities.

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Chapter 4

On Quimbaya goldwork (Colombia), lost wax casting and ritual practice in America and Europe

Alicia Perea

Introduction

When I first assumed research on Prehispanic metallurgy, it was inevitable to fix a supporting point on Prehistoric Europe, my own academic background. I was not the first, and would not be the last to jump from one world to the other, but the question was whether to make a theoretical profit of the circumstance, or let it be a hindrance. Comparative studies on metallurgy from both continents is seldom undertaken if ever (La Niece and Meeks 2000; Perea *et al.* 2004), compared with other research issues like the processes leading to social complexity which have been contrasted and evaluated more frequently (*e.g.* Kohl and Chernykh 2003). With some caution, it is my opinion that looking at both sides might help to understand and to explain these very different technological realms. Problems come when we look only in one direction. As Lechtman (1993, 253) said not long ago, New World metallurgy was never taken seriously by scholars because it was always seen against the backdrop of an ancient European and Near Eastern stage.

In this paper I will examine some aspects of the Classical Quimbaya (Colombia) gold production as opposed to Prehistoric metallurgy in Iberia. The focus will be fixed on two main issues concerning technological as well as ideological aspects of metallurgical practice. On the one hand, lost wax casting, as a technological paradigm, and on the other the ritual dimension of metal production and use as a means to privilege some actions over other more quotidian activities, to show dominance in status or to construct power relations.

But first let us have a general look on metallurgy in the New World which is divided into two technological domains. As Hosler (2009, 190) notes:

In Colombia, metal was treated as a liquid and objects were cast in open molds, in one or two piece molds, or

by the lost-wax method ... In Ecuador, Peru, and parts of the south-central Andes, metal was treated as a solid, and objects were formed by hammering them to shape from an original cast blank.

Traditionally, progression of the technology takes a southern-northern direction, both by land reaching Colombia by the 6th century BC, and by sea as far as West Mexico by AD 600 (Lechtman 1984; Lleras Pérez 2007; Hosler 2013). This is not to say that we uphold a strictly diffusionist explanation, but we have no alternative to the rather poor archaeological data of contexts and the scarcity of radiocarbon dates. Metal chronology has been traditionally constructed by appealing mainly to stylistic or technological arguments. The first archaeological evidence for the use of metal draws back to 1500 BC in the central Andes (Lechtman 1988; Burger and Gordon 1998) although we still lack a complete and clear picture of the technological progression. Be as it may, once the technology was established, regional developments took very different forms in terms of the particular social, ideological and political interests, and natural resource and metal availability (Hosler 1988a; 1988b). During the last decade of the millennium, research came to a turning point concerning metal and particularly gold recovered from scientifically controlled excavations, and in some cases from important monumental sites in the Central Andean region like Sipán or Batán Grande (Alva and Donan 1993; Shimada 1994; Masahiro and Shimada 1994; McEwan 2000).

Except for iron, which was introduced by the Spanish conquistadors, a wide range of different metals was worked depending on the particular social groups, regions and dates. These include copper, tin, lead, platinum, gold, silver, and alloys thereof. No doubt goldworking was common to all metal using societies of the Americas, and this is because prehispanic metallurgy was based on symbolic meanings

rather than utilitarian ones as it was the case in Europe. Different ontologies¹ towards metal explain most of the technological, social and ideological oppositions between the Old and the New Worlds, but not all. It is not only symbolism that we are dealing with, we must cope with metal objects as animated actors within their original social contexts (Alberti and Bray 2009, 338). This is not new to pre-Columbian metallurgy. Referring to the origins of the technology, Hosler (1995) pointed out that sound and colour were the key properties looked for by craftsmen in metals and alloys rather than hardness or durability, because they acted as metaphors of the cosmological schema and the political ideology in the central Andes, Colombia and western Mexico, and only a small component of the typological, as well as technological, repertoire belonged to strictly utilitarian spheres.

It is precisely this dichotomy between utilitarian and non-utilitarian metal production that is one of the key points in the debate on the beginnings of metallurgy in Western Europe. It is well known by archaeological evidence that the introduction/transmission/invention of a new material or technology in the social system tends to be appropriated by the elite and used for its own benefit. This is normally achieved either by accumulating or controlling the new production process and/or its distribution. During the Chalcolithic, at the dawn of metallurgy in the Old World (Roberts *et al.* 2009) metal objects were tentatively non-utilitarian, like adornments or prestige items – either in copper or gold – to be quickly overcome in number by the production of weapons and tools, followed by the upsurge of harder alloys and more efficient technical procedures till the introduction of iron. This sequence is not known in pre-Columbian metallurgy. Following Lechtman (1993, 262):

Metals performed at a totally different level in the New World from that in the Old. Their locus was in the realm of the symbolic. Andean domains of life in which metals were most important were those domains associated with political power, status display, and religious affective force. That is not to say that Andean societies lacked tools or even weapons of metal. They had and used both. What differed markedly in the Andean culture area was the emphasis in metal production, the kinds of objects at the center of metallurgical attention because they were at the center of social attention.

The Quimbaya gold production area

The case study I am considering is the Quimbaya metallurgical group, a particular goldwork production region of Colombia in the middle Cauca River valley that runs between the Central and Western Cordilleras. It was one of the eight groups characterised by Pérez de Barradas in the first half of the last century, based on stylistic features but lacking chronological references (Aceituno 2008). Although still

in use, these groups have slightly changed their meaning, in favour of a more comprehensive division between two metallurgical provinces, North and Southwest, where no less than 12 different goldworking traditions coexist (Plazas and Falchetti 1986; Plazas 1998). The Quimbaya goldwork style is part of the Southwest tradition that developed between about 500 BC and AD 500/700 during what is known as the Classic or Early Period (Plazas 1998; Uribe 1991; 2005; 2007; Bray 2000, 102). Geographically the area is situated at the southern fringe of the Chibchan speaking world (Hoopes 2005), home of the prototypical chiefdoms as defined by Carneiro (1981).

There is a lack of information about the social and territorial organisation of the Quimbayas. We do not even know if this was the same ethnic group met and described by the Spanish conquerors (Stovel 2013). The problem is to connect goldwork items with the archaeological data. We can say without much risk that only some of the hints that define complexity in terms of social organisation appear in the Quimbaya area, such as goldworking itself, the construction of special tombs with extremely rich grave goods near ceremonial open spaces, and a complex iconography that includes the human figure and zoomorphic and phytomorphic images. Most probably this shift to greater complexity occurred for all the Chibchan area in the temporal horizon of AD 300–600, characterised by Hoopes (2005) as a time of technological and iconographical florescence. Mobility and a network of interaction between elites, from the north as well as from the south, seems to be one of the roots of this phenomenon, more the case if we take into account that the Cauca River acts as a natural route. Throughout the region gold is easily available, and copper is not difficult to get.

One of the few contextualised Quimbaya gold assemblages has been kept in Madrid at the Museo de América since 1892. This collection consists of 135 (museum inventory numbers) gold and *tumbaga* objects, which were found in two nearby pit tombs with lateral chambers at the site of La Soledad in the Department of Quindío (Plazas 1978; Perea *et al.* 2013; Verde 2016). Apart from the quantity, it is exceptional for the fact that we know its archaeological context, although both sets were mixed after the plundering. From the stylistic point of view it was dated to the Classic Quimbaya period, between 500 BC and AD 500/700, which confirm the associations of these precious metal artefacts with Brown ware Incised pottery (Uribe 2005).

Between 2010 and 2013 we undertook a research project for the study of this assemblage (Perea *et al.* 2013; 2016a). Our aim was in the first place to define Quimbaya technology, from craftsmanship and analytical points of view – using OM, SEM-EDS, XRF and PIXE-RBS analytical techniques, and X-ray imaging – and in the second place to undertake an iconographic study and program of dating (AMS).

From the technological point of view, the Madrid Quimbaya treasure, as it is known, shows the excellence

of lost wax technology combined with surface depletion gilding, used both as an enrichment treatment and as a means to produce multi-coloured objects with yellow, red and white hues (Perea and Rovira 2016). We have documented different casting variants including: open cast with one or two interior cores; and casting-on for unions and repairs. The latter comprise tasks like filling voids or closing the circular holes left by the pegs that sustained the inner clay cores. A useful index for the excellence of the technological process is the size span of the castings that varies from 53 cm long of the biggest item to 0.16 cm of the smallest. All these processes speak of a good knowledge/control over alloy composition, viscosity and temperature. Skilled modelling of the wax stands out in the smooth shiny metal surfaces, making finishing processes unnecessary except for the burnishing to flatten down the metal plugs. Other minor workshop processes included retouching with punches and chasing tools, cutting, inlaying of materials other than gold and plastic deformation by hammering.

We measured a wide variety of metal alloys ranging from almost pure gold to mixtures up to 50% Cu, the so called *tumbaga* alloy (Gutiérrez *et al.* 2016, fig. 61). Silver contents range between 0.83% and 38%. From the ratios of the Ag–Cu percentages we infer that Quimbayas were probably using alluvial gold from different sources, with various natural silver contents, to which they added different quantities of copper. The skillful use of surface treatment – *mise en couleur* as described by Spanish chronicles – made possible for a low gold object fabricated in *tumbaga* to look as if it were pure gold. But this is a mischievous argument, peculiar to a dualistic ontology concerning metals and their values in a West European reality. As stated by Lechtman (1984, 30): ‘The basis of Andean enrichment systems is the incorporation of the essential ingredient – the gold or the silver – into the very body of the object. The essence of the object, that which appears superficially to be true of it, must also be inside it’. In our case it is the copper, not the silver that is the essential ingredient inside the object.

Another ‘essence’ of the Quimbaya gold production was not only colour but sound. This is a well-known characteristic of all pre-Columbian gold productions, from Mexico to South America (Hosler 1995). No less than 31 ear plugs formed part of the Madrid assemblage, most of them acted as bells with different sounds depending on the particular alloy used in its fabrication (Gudemos 2016). Apart from that there are five bell pendants, of a very widely distributed type in the area. Other pendants and repetitive necklace elements and beads are in the shape of schematic or fantastic animals and insects, mainly frogs (Gutiérrez 2016, 134).

However, the items that stand out as the best known and characteristic of this assemblage are the *poporos*, vessels and long pointed sticks for keeping and consuming coca leaves mixed with lime. It is this group of major items that attracted popular attention for their detailed representations

of naked men and women in ecstatic attitudes, eyes wide shut, either standing or seated in small benches or pedestals, a metaphor of wisdom and authority (Figures 4.1 and 4.2/ Colour Figures 4.1 and 4.2). Genitals are very explicit and in the case of women oversized; in one case a seated woman was represented in advanced pregnancy (Figure 4.3). They all wear headdresses, adornments like necklaces, nose and ear rings, and tattoos or scarifications of the face. Other containers feature big seeds or different forms of pumpkins and local cucurbits. The sticks are long pointed pins crowned with a figurative head, either anthropomorphic, zoomorphic or phytomorphic. In total there are 21 containers and nine sticks.

Finally there are five so called helmets, most probably headdresses, very similar to those represented in the gold figurines themselves, either in men or women.

Surprisingly the interior of some containers still held quantities of a grey to black dusty substance and small fragments of cremated bones, stuck to the inner walls, that were analysed and identified as human (Robledo and Trancho 2016). The ashes were mixed up with remains of the charred clay inner core. This circumstance permitted us to obtain seven AMS dates. These, together with other dates obtained by Plazas (1998) and Uribe (2005) were the basis for the laying out of a Bayesian model (Perea *et al.* 2016b). Results show a time span of cal AD 341–520 and cal AD 390–435 (1 σ) for the moment of manufacture, and cal AD 408–565 and cal AD 411–540 (1 σ) for the cremation of the corpse. It seems that the moment of fabrication, use and interment were very close. Our hypothesis is that the containers were manufactured precisely for their use in the funerary rites related with coca consumption and the ingestion of a corpse or corpses. There are some chronicles and ethnographic evidence on the consumption of the ashes of the corpse as a relatively widely spread ritual in South America (Gutiérrez 2016, 96–97).

This is consistent first with the absence of use-wear traces in the objects, and secondly with the fact that all the sticks present their figurative head smashed or the body folded (Figure 4.4). It is possible that some of the *poporos* also suffered a kind of ritual damage judging from the cutting traces observed in some parts of the body (hands and head in one item). But we are not completely sure if these traces are not the products of post cast manipulation.

Here we have a good example of the Western divide between mind/matter, object/subject, culture/nature, characteristic of our Cartesian ontology. Research on the Quimbaya figurines has traditionally speculated on the identification of these men and women as if they were portraits/representations of *caciques* or shamans (Rodríguez 2007). Other researchers put the emphasis on the symbolism of fertility (Uribe 2005). And still others interpret the complete set as characters in an initiation ceremony for *caciques* (Gutiérrez 2016, 125). In my opinion



Figure 4.1 Gold vessel (poporo) in the form of a woman seated on a pedestal with palm leaves in each hand. Madrid Quimbaya Treasure. (Photograph: Archivo Au (IH, CSIC), F. Cuesta)



Figure 4.2 Gold vessel (poporo) in the form of a standing man with hands on the belly. Madrid Quimbaya Treasure. (Photograph: Archivo Au (IH, CSIC), F. Cuesta)



Figure 4.3 Gold vessel (poporo) in the form of a pregnant woman seated on a bench with her hands on the belly. Madrid Quimbaya Treasure. (Photograph: Museo de América, Madrid)

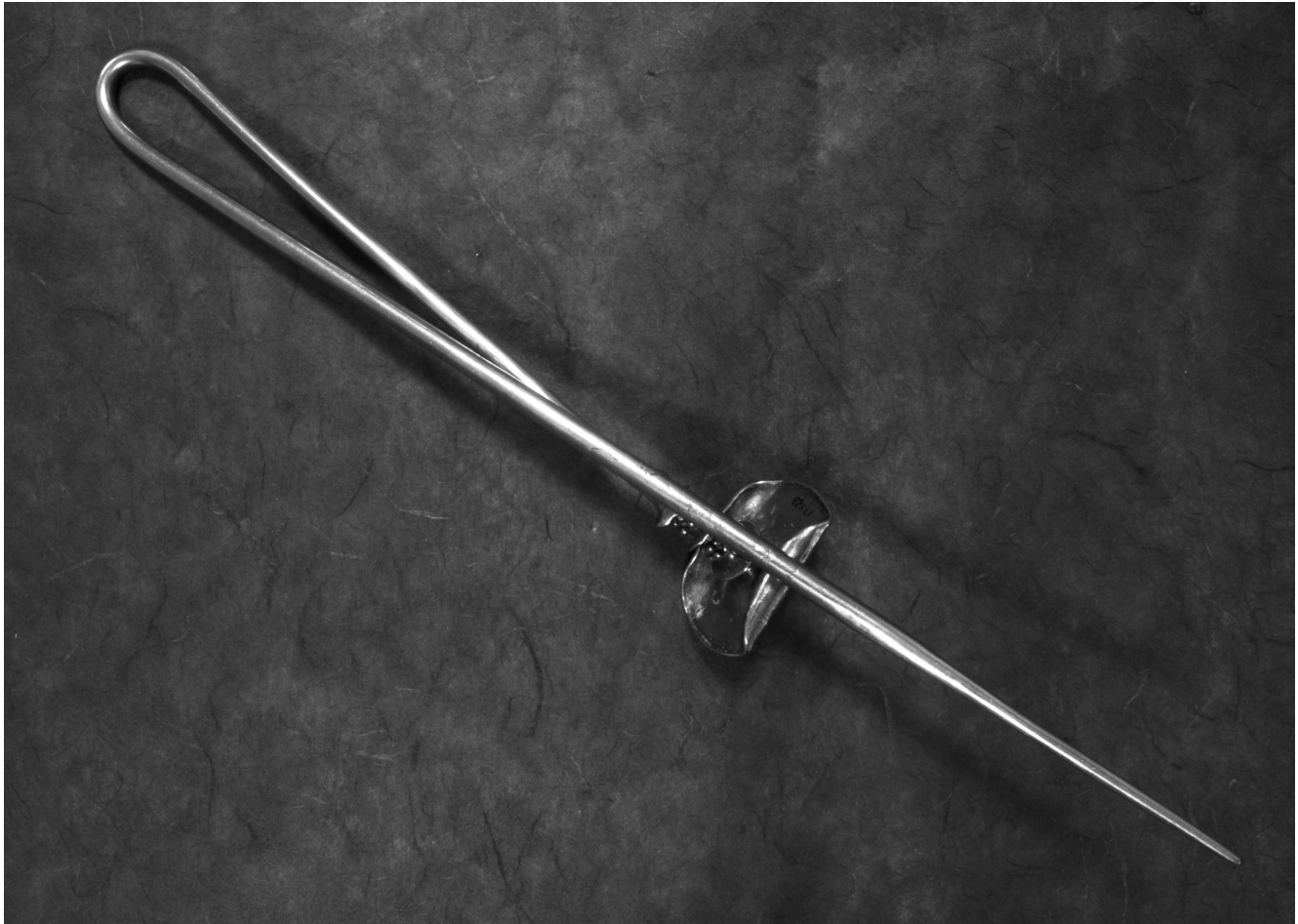


Figure 4.4 Gold folded stick with smashed head. In its original straight form it was used with the poporos in the consuming of coca leaves. Madrid Quimbaya Treasure. (Photograph: Archivo Au (IH, CSIC), F. Cuesta)

the functionalist explanations are excessively dependent on the ethnohistoric and ethnographic record, with all the bias it entails. I am not denying the symbolic dimension of these figurines, but this is a reductionist/narrow focus. Instead of finding out what the figures are telling to us, I propose an inquiry about what was told to them, and from this perspective the figurines come to life.

In this respect there are two important issues. Inside the containers we found almost one hundred gold micro-beads mixed with the ashes. They are tiny objects of around 0.2 cm or less, made in series by lost wax casting or folding a gold sheet, of different shapes but mostly cylindrical, and they present fresh surfaces as if recently made (Perea 2016, 201–202, figs 86, 87). They never reproduce the same shapes of the beads that form part of the life-size necklaces; and the metal used in their fabrication has a different compositional pattern from the rest of the assemblage (Perea 2016, fig. 84). We can infer that this is an intentional way to differentiate them from the others and that they were not meant to be used in a string by the living. We can speculate why they introduced such objects with the bones, and we could readily

answer that they were meant as dispersers to avoid the caking of the dusty ash and facilitate the mixture with the coca leaves. This explanation is consistent with our Western ontology, and probably it was also true for the Quimbayas, but it is not the whole truth, as we will see.

The concept of *camaquen* was defined by Bray (2009) in an attempt to explore alternative, specifically Andean, ontologies through archaeology, as a generative life force that infuses and animates all matter. This concept applies not only to persons but to manufactured or natural objects, places, animals, vegetation, definitely the natural environment. There exists a personhood of objects as there is a personhood of people and a personhood of places where they both interact in the world. So we must understand the Quimbaya figurines, and the ceremonial place in which they acted and were finally deposited, not as passive materialities or symbols but as ‘efficacious, vitalistic, and agentive’ (Swenson 2015, 682). The figurines were not representations of anybody, they were real, important somebodies and as such they deserved offerings like gold beads, even though different. They were embodiments of

the ancestors that deserved to be consumed by the living people in a coca ceremony – a holy communion – in an adequate and sacred place, and in order to obtain/regain/maintain political, ideological, or social benefits. In other words, they were meant to perpetuate cosmological, and social, order through rituality.

The Iberian Late Bronze Age gold production

In the light of the above case study I would like to counterpoint the one of the Iberian gold of the Late Bronze Age (c. 1500/1250–750 BC). During this period, new metal production processes, distribution and consuming practices stand out in the Iberian Peninsula as well as in the whole European continent (Ruiz-Gálvez 1998; Mordant *et al.* 1998; Pare 2000; Burgess *et al.* 2007; Fokkens and Harding 2013; Meller *et al.* 2014). Poor archaeological evidence for funerary practices and widespread metal hoarding are only some of the most outstanding general characteristics of the period. Precisely it was metallurgy during the previous 3rd–2nd millennia, and mass production of weapons, the traditional basis for the construction of economic and social organisational models, from chiefdoms to pre-state and even state societies (Chapman 2003; Lull *et al.* 2010), depending on the regional developments, putting the focus on early hierarchical organisation, exploitation and coercion. It is during the European Bronze Age that the sword became a generative mythographic element.

Hoarding practices on the Iberian Atlantic seaboard provide evidence that there were two separate production-circulation conduits for bronze and gold, which means that different technological processes were developed (Armbruster and Perea 2007; Perea 2014). Gold hoards are traditionally known as ‘treasures’ and consist of objects of adornment, mainly torcs and bracelets, generally in good condition, although different biographies can be assumed from wear traces (Perea and García-Vuelta 2012). In other cases items are damaged in various ways and to varying extents, a fact that has been systematically interpreted due to their dicing before being melted down. This simplistic view, which wanders up the economy and down the crucible, has prevailed in the archaeology of the Iberian Peninsula.

A diachronic review of these hoards actually reveals a much more complex and varied panorama. The complete/fragmented dichotomy (Chapman 2000; Chapman and Gaydarska 2007) is no longer enough to explain the archaeological evidence. There are more than a third category of hoards that have not been typified, for example: those that contain objects made up of various independent elements capable of being fused together, added to or divided without losing their integrity or ‘essence’. The fusion/addition of various separate objects in order to form a new one, probably with a different meaning from the original, also requires an explanation that takes ritual behaviour into

account. The same is true of divisibility. These practices have to be seen as part of the identity mechanisms of chaining, fragmentation and accumulation, described by anthropology as practices that construct individual and social personhood (Fowler 2004). I put forward a case study that displays the complexity of these behaviours and a particular technological conundrum in relation to lost wax casting.

Two decades ago no one thought about lost wax casting as a technique that could characterise Late Bronze Age gold metallurgy in Iberia, and even less about the existence of complex rotary motion tools associated with this technological process. Basic processes of goldworking relied on plastic deformation and mould casting. A particular type of gold hoard, widely distributed along the Atlantic seaboard and extending through the high central plateau to the Mediterranean, came to change this traditional panorama. Although it is true that this particular technological process was restricted exclusively to a particular type of object, mainly heavy bracelets and only some few finger rings, always found in hoards. This pairing of object type/technological process is known as Villena/Estremoz (V/E) in reference to the most renowned findings.

The V/E type of hoard contains normally one, or at the most two, characteristic cylindrical and heavy bracelets (Figure 4.5/Colour Figure 4.5); only once we find a considerable number of bracelets being part of a single hoard together with different types of objects reaching 9 kg of gold, but in this case the concealment was located out of the Atlantic seaboard in Villena, Alicante (Perea 1994). All the bracelets show a perfect circular symmetry and an intricate decoration that combines three structural elements in various ways: ridges, spikes and openwork (Armbruster and Perea 1994). They vary widely in terms of size, weight, technical and decorative complexity: their weight ranges from 50 g to 978 g and they were made using a sophisticated process that included massive lost-wax casting and the use of an alternating rotary lathe² for shaping the wax model and for the finishing stage of the cast metal object. Thus their morphology and manufacturing process were completely different from those of the rest of gold types in the Iberian territory of the time. We can assume from this fact that they were products controlled by, and distributed between, different groups.

We know of a total of 48 bracelets of this type, of which 85% appear to have been deliberately fragmented after the manufacturing process and use, although some items look freshly made. The fragmentation was produced by opening or cutting a piece off the cylinder by abrasion, probably using a flexible tool – some kind of fibre or leather – with an abrasive material such as sand or powdered sandstone and a lubricant such as water or oil (Figure 4.6). The characteristics of these cuts must also be taken into account. First, the cut was made with surprising precision: for example, in some of the bracelets, the cutting line passes



Figure 4.5 Bracelet of the V/E type found at Estremoz, Portugal. It is one of the few in complete cylindrical shape. Museo Arqueológico Nacional, Madrid. (Photograph: Archivo Au (IH, CSIC), A. Perea)

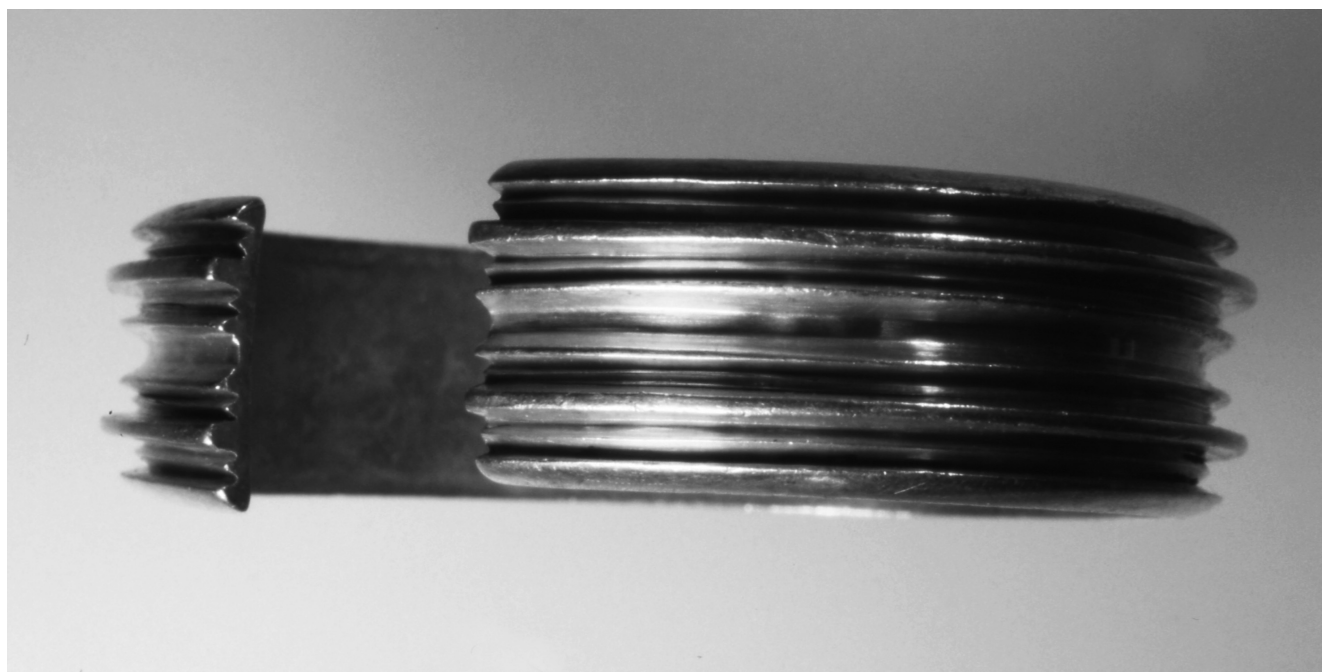


Figure 4.6 One of the 28 fragmented bracelets of the V/E type found with other gold items in Villena, Alicante. Museo Arqueológico José María Soler, Villena. (Photograph: Archivo Au (IH, CSIC), A. Perea)

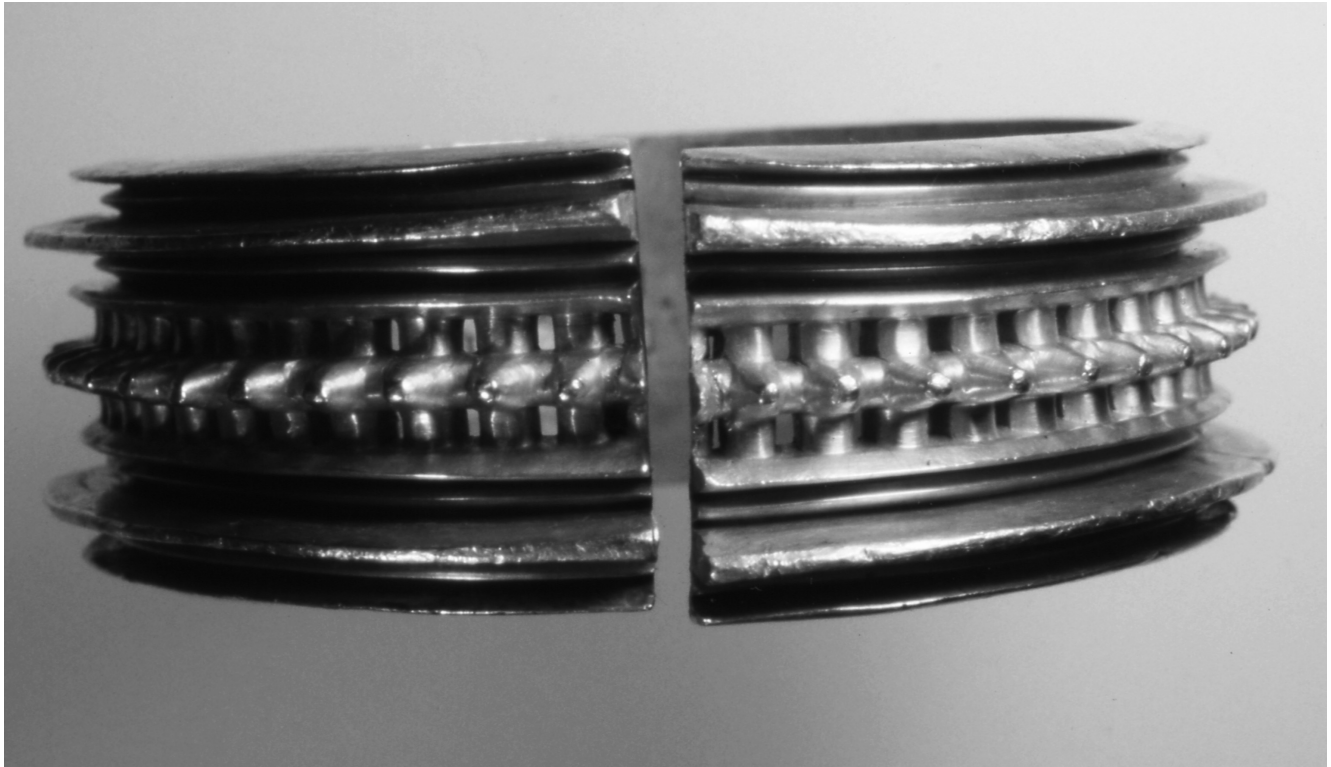


Figure 4.7 One of the bracelets from the Villena hoard (Alicante), with a very precise cutting of the cylinder. Museo Arqueológico José María Soler, Villena. (Photograph: Archivo Au (IH, CSIC), A. Perea)

exactly through the centre of a conical point, dividing it in two perfect halves. Secondly, the size of the cut is very different in different examples: in some two cuts were made in order to remove a relatively wide piece of the cylinder, while in others only a single cut has been made and the edges are almost touching (Figure 4.7/Colour Figure 4.7).

A single hypothesis was suggested to explain the systematic openings in the V/E bracelets. The mercantilist model of Ruiz-Gálvez (1995) relates fragmentation to the payment of transit taxes along livestock routes. This model was based on a single find, the Villena (Alicante) hoard near the Mediterranean coast, made up of 28 fragmented bracelets. Their weights would be fractions in a weight system of Mediterranean origin.

In my opinion (Perea 2008), the fact that the fragmentation is not uniform in all the items could be of accounting, but not necessarily metrological significance. But the mercantilist model does not explain the fact that in some cases the bracelet has been cut without removing any material. In my belief the cuts described above were made as part of a ritual ceremony subject to strict rules. The argument is based firstly on the difficulty of the chosen method of cutting by friction using a process that must have taken several hours or days, involving great effort and expertise, instead of using a hammer and chisel to perform the fragmentation in no more than a few minutes of moderate effort. The second consideration that supports the ritualist model is that

the process chosen seems to have been intended to avoid disfiguring the object at all costs. Cutting it with a chisel would have destroyed its perfect circular symmetry. And finally, the varying amounts of metal removed could have made reference to redistribution between the human and divine worlds (Nebelsick 2000, 169–170).

The emergence and consolidation of elites during the Bronze Age on the Atlantic seaboard entailed the need to construct their own identity as a distinct group, and the possibility of manipulating identitarian mechanisms politically in order to generate or consolidate power. Objects become receptacles for memory, they are endowed with personhood and therefore play an active role in these power struggles. In this way, new forms, new technologies, and new messages emerge to replace old and useless objects and processes.

Discussion

I would like to stress upon two issues in the light of the above case studies. Even if so different in time, space and semblance they bear important similarities like the idea of technological excellence and rituality as social/political strategies.

The skill of a craftsman has been considered a subjective/cultural category, difficult to analyse and impossible to quantify. Nevertheless, if we define skillfulness as a special kind of technical knowledge, we should be able to compare

with the rest of technology and so to determine its quality, at least in relative terms (Bleed 2008, 157). We can even take some hallmarks to evaluate its position with respect to other crafts. For example regularity, standardisation, perdurability, or expressiveness, all speak of careful, repetitive behavioural routines in the frame of a mature technological process. Smart or 'cognitive tools' has been put forward as another element to feature skillfulness (Bleed 2008, 158), and I should add the capacity of combining a variety of different raw materials in the same manufacturing process. It is my opinion that both Quimbaya and V/E gold productions, integrated in their own social, ideological and technological sceneries, bet for technological excellence as an intentional option to achieve empowerment and visibility. They both devised the same strategy to distinguish themselves from the others.

Comparing Quimbaya goldwork with other gold productions of the area is clarifying. The Muisca gold of the eastern highlands of Colombia, is well known for the proficiency of its lost wax castings and the precise modelling of the wax in fine threads. It is also remarkable for its complex figurative iconography and for the rituality involved both in the manufacturing process and in the depositional practices as votive offerings (Uribe-Villegas and Martín-Torres 2012). Nevertheless it also stands out for the 'unfinished' state of the produced objects, with limited post-casting work. They are left with unrepaired casting flashes or errors, and very little cleaning or finishing work (Martín-Torres and Uribe-Villegas 2015, 138). It seems clear that the Muisca were not interested in excellence, even though skilful craftsmen, because their production was not made to be displayed (Martín-Torres and Uribe-Villegas 2015, 151).

In the case of the Iberian Late Bronze Age gold of the V/E type, there is also an intentional effort to differentiate from the ordinary production widespread throughout the Atlantic seaboard (Perea 1999; Perea and Armbruster 2007); those are solid gold torcs and bracelets formed by a simple hoop with a round cross section and smooth surface decorated with incisions in a geometric pattern, and as we said above, worked by the plastic deformation of a pre-shape cast. On the contrary, to manufacture the V/E type of bracelets, with pointed spikes in between ridges and openwork in a dramatic light and shadow contrast, they had to develop a technological process based on the shaping of the wax model working with hot blades over the horizontal axis of an alternating rotary lathe, a really smart and new tool.

Rite is a complex social behaviour that, traditionally, was defined as a strategy to cope with contradictions/oppositions in order to maintain social cohesion. But there is much more on rite. It acts as a double way valve, in one way as a mechanism of submission and in the other for transgression. This is the reason for the existence of two-faced theories, rite as a social agreement mechanism and as a coercive one (Bloch 1989; Bell 1992). In my opinion, the ritualised

behaviour implicit both in the depositional features as well as in the technological processes of the cases above, is paradigmatic of these opposed theories. And I say 'ritualised technological processes' because 'complex procedures are necessarily ritualized' (Budd and Taylor 1995, 139). But rite is only a means of expression. It has to be endowed with political/ideological content, embodied in certain objects that acquire the identity of the person/group who have access to them. The process of manufacturing, distributing and consuming these embodied objects would generate social relations of production and a type of distribution in agreement with the ideology of the group in which that process took place. The person who exchanges, accumulates and exhibits objects also has some control over individuals, and therefore, political power.

The ceremonial consumption of the Quimbaya gold was used to perpetuate social structures and technological processes, if we are to judge by its long life production period with very similar archaeological features. On the contrary, Late Bronze Age V/E gold, as a technical innovation episode and a morphological/typological transgression was a short period time phenomenon. There is no contradiction in that they both met their objectives.

Conclusion

Starting from the technological processes and depositional contexts of two assemblages of gold objects I have undertaken a comparative approach almost in an experimental way. My aim was to elucidate different ontologies concerning knowledge and practice of metallurgy in different cultural domains. In the one hand Pre-Columbian metallurgy as expressed in the Quimbaya region of Colombia, and in the other Prehistoric goldwork of the Late Bronze Age in the Atlantic seaboard of the Iberian Peninsula. These two social domains developed complex tools and particular lost wax casting processes for the manufacturing of ideological objects used in ceremonies or exchange rites of very different nature.

Differences were obvious, but surprising similarities came to light concerning power strategies in order to perpetuate, in one case, or transgress, in the other, social order. These strategies used technology as a political weapon. It is well known, but still necessary to remember, that technological processes do not respond to random or evolutionary phenomena, not even to convenience, but to man's capacity for making choices and decisions. Technology implies intentionality and has a meaning, hence it can be interpreted and manipulated. In our two case studies it was excellence and innovation applied to gold production the means used by the leading elites to obtain social and ideological revenues. At the other end stands rituality both as a magic recipe for technological success, and as a useful scenery where to construct social realities, obligations and fear.

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Notes

- 1 Ontology as defined by Swenson (2015, 680) referring to ‘historically specific structures of being, presence, reality, and personhood’ and materiality understood as encompassing ‘explicit traditions of engagement with the physical realm (incorporating production, consumption and perception).’
- 2 We say ‘alternating rotary lathe’ because at that time the potter’s wheel, with its continuous turning, was not yet invented. This only arrived in the hands of Phoenician colonists a bit later.

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Chapter 5

Bronze production and tin provenance – new thoughts about the spread of metallurgical knowledge

*Bianka Nessel, Gerhard Brüggemann, Daniel Berger, Carolin Frank,
Janeta Marahrens and Ernst Pernicka*

Introduction

Profound technological and social changes took place on the Eurasian continent between the second half of the 3rd and the end of the 2nd millennium BC. Most scholars believe the invention of tin bronze technology was a key factor in these developments (*e.g.* Strahm 1994; Hänsel 1998; Kristiansen and Larsson 2005), but other views have been proposed (*e.g.* Bartelheim 2002).

The earliest tin bronzes occur in the Near East already between the 6th and 4th millennium BC, but the chronological positions and contexts of these objects are uncertain. Tin bronze increases noticeably around 2800 BC, and the material is frequent in the region during the second half of the 3rd millennium BC, a period when it is also common in Anatolia, the Aegean and around the Persian Gulf (Pernicka 1995; 1998, 139–41; Apakidze 1999, fig. 2; Weeks 1999; 2004; Hauptmann and Pernicka 2004). Metal trade in Mesopotamia and the Eastern Mediterranean is comparably well understood. Written documents from Kanesh in Anatolia and other sites dating to the 2nd millennium BC record a gradually increasing price of tin as the raw material was traded further westwards (Joannes 1991; Veenhof 2003, 115–16; Veenhof and Eidem 2008, 82–83). But local tin exchange rates differed and depended on political and economic alliances, and during a few years in the 18th century BC, the Kingdom of Mari could procure tin for half the usual price due to changes in the political power of neighbouring empires (Limet 1985, 16–17; Charpin and Durand 1991). In Europe, on the other hand, where such sources are lacking, the supply and distribution of tin is still an unsolved research problem.

This chapter reviews the archaeological research regarding Bronze Age tin and discusses methodological issues in acquiring tin isotope data from metal objects and

ore sources. It presents and compares preliminary results of tin isotopic research on Early Bronze Age metal artefacts from 3rd millennium BC contexts in Mesopotamia and the Únětice culture of Central Germany (2nd millennium BC).

Early tin bronze metallurgy in Mesopotamia and Anatolia

Bronze metallurgy in the Near and Middle East has long been the focus of archaeological and archaeometallurgical research. One of the first projects analysing the chemical composition of early metal objects on a broad scale was S. Junghans, E. Sangmeister's and M. Schröder's *Studien zu den Anfängen der Metallurgie* (1960–1974). Even though this study focused on European copper-based objects, it also included about 1000 Anatolian and Mesopotamian objects from the 3rd millennium BC. About 200 of these were made of tin bronze. J. Muhly laid the groundwork for future approaches by reviewing the state of research on Old World bronzes and considering which tin sources possibly supplied Early Bronze Age cities in Anatolia and Mesopotamia (Muhly 1973; 1976).

Most of the earliest tin bronzes in Anatolia cannot be dated accurately because their archaeological contexts are not reliable. The dating of several bronze figurines from Tell Judaidah to the early 3rd millennium BC is challenged (Yakar 1984, 70; Weeks 2004, 174). A few bronzes from the Carchemish region are dated to the 3rd millennium BC, but their contexts cannot be assigned reliably to a specific period (de Ryck *et al.* 2005, 264). Early tin bronzes have, however, been found in well dated contexts at Troy (Yakar 1984, 74), Beşiktepe (Begemann *et al.* 2003, 179 Tab. 2, 181) and Çukuriçi Höyük (Horejs *et al.* 2010). The number of tin bronze objects increases in Early Bronze Age II, most

apparent from the middle of the 3rd millennium BC. The alloy was used to manufacture vessels, daggers, axes and bracelets. These early bronzes occur primarily in burials and hoards. The best investigated examples are the graves from Alaca Höyük, Ahlatlıbel and Horoztepe, all dating to the Early Bronze Age III period (Yakar 1985, 30–31, 33–34). Treasure A from Troy can also be mentioned (Hänsel 2014, 144–47).

The forms of many items, including daggers and crescent axes indicate a Mesopotamian influence on Anatolian metalwork, especially around Horoztepe (Yakar 1985, 37). Analyses of Anatolian bronzes were published and discussed by Esin (1969) in one of the earliest studies on Early Bronze Age metallurgy. Additional studies by de Jesus (1980) followed. Yakar (1984; 1985) discussed the available archaeological and archaeometric data, specifically the appearance, distribution and types of Early Bronze Age metal objects in the different cultural regions of Anatolia.

Tin bronze appears in the Caucasus region in greater numbers first in the last third of the 3rd millennium BC (Chernykh 1992, 14, fig. 6). There is, however, a small number from the middle of the 3rd millennium, e.g. tin bronzes from a grave in Velikent, Dagestan (Kohl 2002, 173, 175–76). From Armenia a spiral tin bronze finger ring was found in a grave at Talin. It belongs archaeologically to the Kura Araxes culture and dates to the first third of the 3rd millennium BC (Meliksetyan and Pernicka 2010, 41).

In Mesopotamia, early tin bronzes appear in significant numbers during Early Dynastic III A, between 2600 and 2500 BC (Hauptmann and Pernicka 2004). In northern Mesopotamia tin bronzes are found in Tell Beydar in ED III contexts (de Ryck *et al.* 2005, 264). A few tin bronze chisels, pins, and metal sheets dating from the second half of the 3rd millennium BC come from Tell Brak and Tepe Gawra (Moorey and Schweizer 1972, 186; de Ryck *et al.* 2005, 264). Additional bronzes from Assur have been analysed, but they date to the Ur III period at the end of the 3rd millennium BC (Hauptmann and Pernicka 2004, 7–8, cat. no. 82, 116, 109). Bronzes from Tell Kara Kuzaq at the northern Euphrates can be dated stratigraphically to the Syrian Early Bronze Age I, which is roughly contemporary with ED I in Mesopotamia (Montero Fenollós 1997, 10–11). Besides shaft-hole axes, axes, daggers and spearheads, vessels and pins were also made of tin bronze. Well-known examples from this period come from Ur and Kish (Moorey and Schweizer 1972, 183–85, 194; de Ryck *et al.* 2005, 265), most are prestige goods in rich burials. More than 30% of the analysed copper-based metal objects from Ur in the ED III period are made of bronze. The so-called royal tombs in particular are very rich in tin bronze as many tombs contained more than 10 tin bronze objects (Hauptmann and Pernicka 2004, 42–82). In addition, early bronze objects appear for instance in Susa during phase IVa,

again dating to the middle of the 3rd millennium BC (de Ryck *et al.* 2005, 265).

In contrast to Mesopotamia, hardly any early tin bronzes are known from central and eastern Iran. A few objects were found in Tappe Yahya. Tin bronze was, however, available at the same time at Kalleh Nisar in western Iran (Helwing 2009, 231).

In the area between northern Mesopotamia and western Iran (Kish, Razuk Ağrab and Kalleh Nisar) an experimental phase may perhaps be recognisable, which saw the use of new polymetallic ores at the beginning of the 3rd millennium BC (Helwing 2009, 212), although this did not lead to the rise of a fully developed bronze industry. Large-scale bronze production emerged much later during the late Early Dynastic period. The few bronzes in central and eastern Iran might be explained by long distance trade with the Persian Gulf (Helwing 2009, 215) and through the Mesopotamian plains (Fleming *et al.* 2005).

Because of unreliable archaeological contexts and an insufficient chronological resolution it is currently difficult to determine the direction of the expansion of tin bronze metallurgy. Chronological time frames of up to 250 years are too vague in order to obtain information about the invention and regional spread of this new technology. Archaeological studies of early bronzes, and information about directions and limits of interaction, transportation of raw materials and the structure of exchange networks, need to be supplemented by natural science methods to answer questions regarding production processes, technological knowledge and used materials.

Early tin bronze metallurgy in Europe

The establishment, rise and distribution of tin bronze technology in Europe has received much research interest, especially in recent years. As one of the first scholars, H. Schickler called attention to the fact that some tin bronze objects were manufactured earlier than the beginning of the Bronze Age in central Europe (Schickler 1981). Even if some of them cannot be dated properly, attention was drawn to this terminological and chronological inconsistency. Later on R. Krause confirmed that low-tin bronze objects are found in Bell Beaker and Corded Ware culture contexts in Switzerland and Bohemia (Krause 2003, 210–13). Since the absolute dates of both cultures overlap substantially, it is not possible to attribute the introduction of tin bronze metallurgy to one of them. Several other bronze objects with low tin content that can be dated to the Neolithic are known from the eastern German Baalberge und Salzmünde cultural groups (Müller 2001, 410–18; 2002, 276; Krause 2003, 211–12). J. Czebreszuk described this early phase of tin bronze metallurgy as his second metallurgical stage, starting around 2300 BC. It is characterised by both tin bronzes and a rising number of copper and gold objects. This metallurgical

breakthrough could have been a main feature of social and cultural identity, because the ability to handle the mystical transformation of material may have led to social stratification (Czebreszuk 1997). Yet, it has to be emphasised that Beaker metallurgy should not be understood as fully developed bronze technology. It was still an experimental technology, difficult to reproduce. The same applies for the earliest stage of the Bronze Age (stage Reinecke A1). From the Singen cemetery in Baden-Württemberg, Germany, four Atlantic Bronze Age type daggers consist of tin bronze. They are typologically and technologically much more developed compared to contemporary finds, but they are atypical and probably originate from Western Europe (Christoforidis and Pernicka 1988; Krause 1988, 56–63). This fits well with archaeological finds from the British Isles, which saw an increased production of tin bronze objects around 2000 BC (Spindler 1971, 240–43; Gerloff 1993, 83–85; Rassmann 2004, 43).

A fully developed bronze technology can be documented only from stage Reinecke A2 onwards (*c.* 1700 BC), corroborated by several well dated cemeteries. Many grave inventories contain highly alloyed tin bronze objects such as daggers, pins and earrings (Bertemes 1989, 158–62; Bátor and Pernicka 1999; 2000). Almost all tin bronze items from this phase were either weapons or personal jewellery.

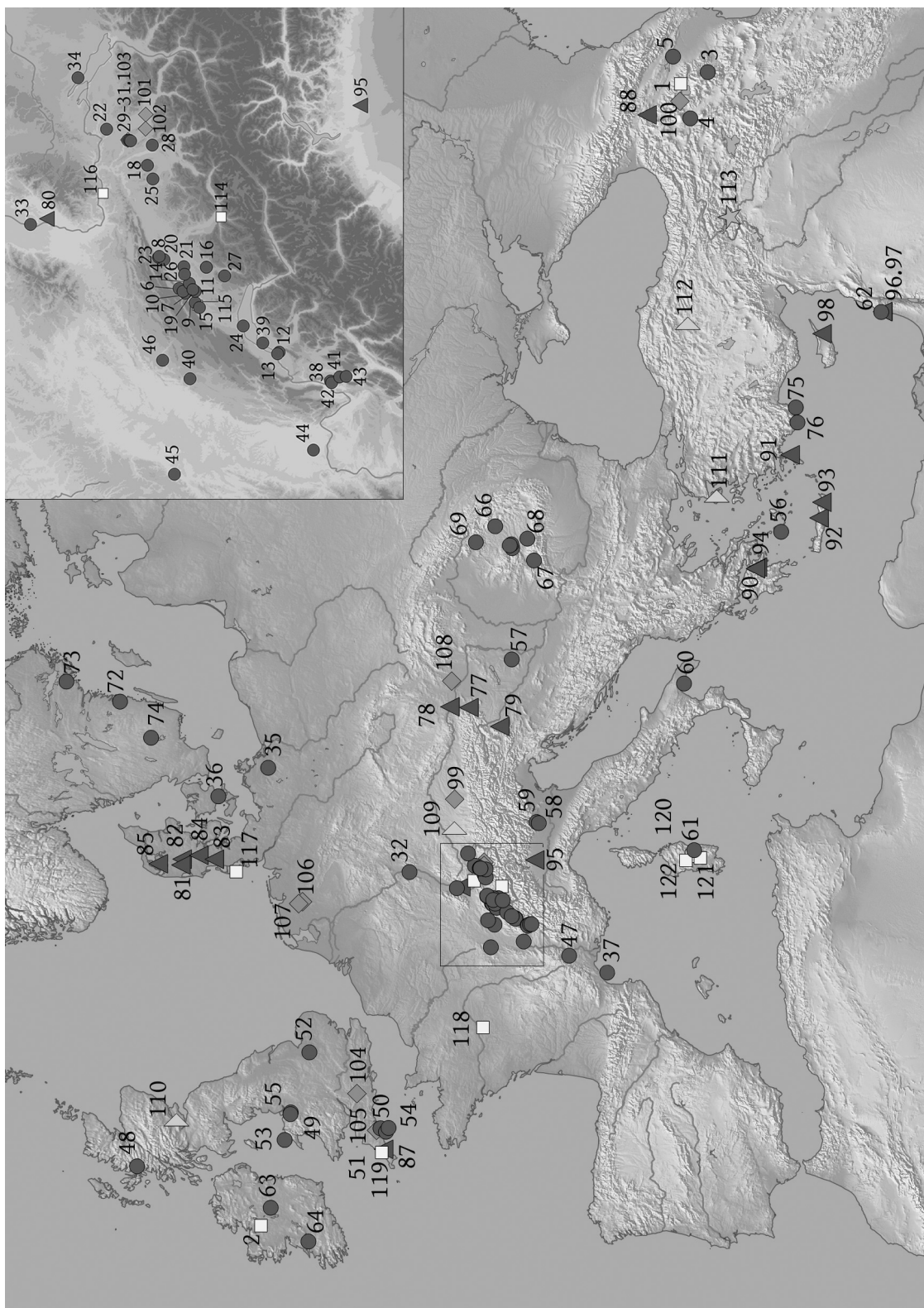
According to the traditional point of view, the European Bronze Age was influenced by the Aegean and/or the Orient. Tin bronze technology was usually considered to spread from early urban centres in the Near East through trade routes along the Mediterranean coastline and/or through the Danube via the Carpathian Basin to communities in central and western Europe. Contacts between the Wessex and Únětice cultures were established and intensified to satisfy the growing demand for tin. One of the cross-regional studies that argued this traditional point of view was made by S. Gerloff in 1993. She claimed that a regular tin trade was established in the Early Bronze Age between Western and Central Europe and the Mediterranean (Gerloff 1993, 83–84). However, difficulties emerged with this concept due to problems concerning the distribution and chronology of the so-called *Ösenringe* und *Schleifennadeln*. This scenario was criticised and revised (Maran 1998), because the Carpathian basin does not cover all parts of the region. A broader range of radiocarbon dates showed that the beginning of the Bronze Age in Western Europe was earlier than assumed (Pare 2000, 2). Accordingly, a hypothesis of a dissemination of the technology in one direction from east to west was no longer plausible. This situation is even more evident now, as shown by new radiocarbon dates from southern Germany (*e.g.* Stockhammer *et al.* 2015). According to Czebreszuk a third stage of development begins with the newly established wealth and influence of the Únětice culture around 2000 BC (Czebreszuk 1997). From *c.* 1800 BC bronze metallurgy became a key economic factor. Besides prestige objects,

various effective craft implements make up the majority of the manufactured bronzes. The number of production centres increased and characteristic types of bronzes became important expressions of cultural identity.

Early tin objects in Eurasia

In contrast to the great number of tin bronzes, there are only a few tin artefacts dating to the Early Bronze Age. Not more than 15 objects are known from across Eurasia (Figure 5.1/ Colour Figure 5.1). From the later stages of the Bronze Age, the number only increases to some hundred. The reasons behind this scarcity of tin metal can be manifold, with socio-economic, technological and conservational aspects as the most prominent. Besides its sensitivity to corrosion, prehistoric tin is said to suffer severe degradation by the so-called tin disease, which converts it to a grey, non-metallic (α -tin) powder making tin objects difficult to recognise in the field (Soles 2004). However, this is disputed since very low temperatures are required for the occurrence of the phenomenon (Maddin *et al.* 1977). Another reason for the scarcity of tin objects during the Early Bronze Age could be the way that tin is smelted. By using the cementation (cassiterite + copper) or co-smelting techniques (cassiterite + copper ores) tin bronzes could be directly produced without using metallic tin. Both production methods may have been employed during the early stages of bronze metallurgy, as suggested by the high variability of the tin content and the scarcity of metallic tin (Herdits *et al.* 1995; Rovira *et al.* 2009). However, tin metal was indeed obtained by direct smelting of cassiterite and thus known as a distinct metal already at the beginning of the Bronze Age as indicated by a couple of early tin artefacts. The oldest European tin object known is a small ring from Thermi on Lesbos, Greece. It derives from a somewhat unsecure context in the settlement, but has nonetheless been dated to about 2500 BC (Lamb 1936; Begemann *et al.* 1992). Even more uncertain is the date (3000–2500 BC) of finds from Tülintepe, Turkey, which were accidentally unearthed by construction works. These objects consist of arsenical copper with a superficial layer of tin (tinning) (Yalçın and Yalçın 2009, fig. 2). A more recent discovery is a ‘tin ingot’ from tomb A at Alacahöyük, Turkey. The object was considered as some kind of metal wrapped into textile before it was recognised as tin. It is radiocarbon dated to the second half of the 3rd millennium BC (Yalçın 2016).

Outside the Mediterranean region, metallic tin was used towards the end of the 3rd millennium BC as well. A button made of jet with tin inlays was found in a cist burial near Rameldry Farm, Fife, Scotland, dated to approximately 2300–2000 BC (Baker *et al.* 2003). Tin beads of similar age (stage Reinecke A1) are known from burials in Buxheim (47 pieces) and Schwabmünchen (about 1000 pieces: Massy 2018), Bavaria, Germany (Möslein and Rieder 1997; Martinek and Möslein 1998; Stolz and Berg-Hobohm 2013).



(from previous page) Fig. 5.1 Bronze Age tin objects in Europe and Near East (star: 3000–2500 BC; triangle: 2500–2000 BC; diamond: 2000–1500 BC; pyramid: 1600–1300 BC; point: 1300–800 BC; square: undated)

1 Kedabek (Kalakend), 2 Rathtinaun (Lough Gara), 3 Akner, 4 Metsamor, 5 Mingeczaur (Mingaçevir), 6 Auvernier, 7 Bevais Sud, 8 Bieler See, 9 Concise, 10 Cortaloid, 11 Estavayer-le-lac, 12 Genève-Eaux-Vives, 13 Genève-Pâquis, 14 Gletterens, 15 Grandson-Corcelettes, 16 Hauterive, 17 Hauterive-Champrevyres, 18 Hitzkirch-Moos, 19 La Crasaz (Vernay), 20 Mörigen, 21 Muntelier, 22 Neftenbach, 23 Nidau, 24 Saint-Prex, 25 Sursee (Gammainseli), 26 Vallamand, 27 Vuadens, 28 Zug-Sumpf, 29 Zürich-Alpenquai, 30 Zürich-Großer Hafner, 31 Zürich-Wollishofen, 32 Bobenheim-Roxheim, 33 Burkheim am Kaiserstuhl, 34 Unteruhldingen, 35 Weltzin (Tollensetal), 36 Bårse, 37 Agde, 38 Châtillon, 39 Chens-sur-Léman, 40 Chilly-sur-Salins, 41 Conjux, 42 Grésine, 43 Le Saut (Tresserve), 44 Montellier, 45 Pommard, 46 Scey-en-Varais, 47 Vallon-Pont-d'Arc (Grotte du Déroc), 48 Auchtertyre, 49 Caergwrle, 50 Dean Moor, 51 Erme River (Bigbury Bay), 52 Flag Fen (Petersborough), 53 Llangwyllog, Isle of Anglesey, 54 Salcombe, 55 Treuddyn, 56 Phylakopi, 57 Aparhant, 58 Lazise (Gardasee), 59 Peschiera, 60 Saturo (Porto Perone), 61 S'arcu 'e is Forros (Villagrande-Strisaili), 62 Haifa, 63 Killsallagh, 64 Knocknaboul bog, Tootadoo, 65 Aiud, 66 Brâncovaneşti, 67 Cioclovina, 68 Gusterița II, 69 Lăpuș, 70 Șpălnaca II, 71 Uioara de Sus, 72 Gladhammar (Färhult), 73 Långbro (Vårdinge), 74 Öjaby, 75 Cape Gelidonya, 76 Kas (Uluburun), 77 Pitten, 78 St. Andrä-Wörtern, 79 Wies, 80 Breisach-Oberriemsingen, 81 Fladshøj, 82 Guldshøj, 83 Lille Dragshøj, 84 Store Høj Barde, 85 Store Kongehøj, 86 Gurob, 87 Caerloggas Downs, 88 Madnistal (Beshtasheni), 89 Athen, 90 Dendra, 91 Ialysos, 92 Knossos, 93 Mochlos, 94 Mykene, 95 Canegrate, 96 Hishuley Carmel, 97 Kefar Shamir, 98 Salamis, 99 Poing, 100 Lchashen (Lake Swansea), 101 Rapperswil, 102 Wädenswil-Vorder Au, 103 Zürich-Mozartstraße, 104 Sutton Veny, 105 Whitehorse Hill, 106 Barger-Oosterveld, 107 Exloo, 108 Blatné, 109 Schwabmünchen, 110 Rameldry Farm, 111 Thermi (Lesbos), 112 Alacahöyük, 113 Tülintepe, 114 Aeschi Bad Heustrich, 115 Onnens, 116 Bad Säckingen, 117 Nebel-Steenodde, 118 Sublaines, 119 St. Columb, 120 Abini (Teti), 121 Forraxi Nioi (Nuragus), 122 La Maddalena (Sılanus-Lei)

A somewhat younger bone object (stage Reinecke A2) from Poing, Bavaria, Germany, is decorated with tin pins (Figure 5.2/Colour Figure 5.2) (Schwarzberg *et al.* 2014). Tin beads from that period have also been found in a tomb from Blatné in Slovakia, and at two waterlogged settlements in Rapperswil-Jona and Wädenswil-Vorder Au at Lake Zurich, Switzerland (Eberschweiler 1999; Primas 2003). A twisted bar from the settlement at Zurich-Mozartstraße adds to the Swiss finds around the Lake (Schmidheiny 2011). Two contemporary tin objects have been found in Barger-Oosterveld and Exloo, Drenthe province, The Netherlands. The first one is a copper dagger with a hilt made of horn, decorated with tin studs (Butler and van der Vaals 1966). The second object is a necklace with 25 tin beads and 18 beads of amber, faience and bronze (Haveman and Sheridan 2006). A cist burial at Whitehorse Hill, Devon, Great Britain contained a strip of textile which is decorated with 34 tin nails (Jones *et al.* 2012). It is radiocarbon dated to the Early Bronze Age (1950–1500 BC) and one of the two oldest finds in southern Great Britain. The other find is a perforated tin bead from a Wessex burial near Sutton Veny, Wiltshire (Hoare 1812).

As seen by the examples listed above, most early tin objects are beads and items with tin decorations. This general decorative and representative character was continued in the Middle and Late Bronze Age, where tin often served as inlay material on metals, ceramics, stones and wooden objects or separately as jewellery (Stjernquist 1958; Fischer 1993; Randsborg and Christensen 2006). This restricted use emphasises its precious value.

However, in the Late Bronze Age (1500–800 BC) another kind of tin objects appeared. A large number of tin ingots, about 180 in total, were found at different locations in the Mediterranean, southeast Europe and southern England. Most were found in shipwrecks in Uluburun (Turkey), Haifa,

Hishuley Carmel and Kefar Shamir (Israel), Agde (France), Salcombe and Erme's Estuary (Great Britain). Not all of them are well dated (Hauptmann *et al.* 2002; Galili *et al.* 1986; 2013; Needham *et al.* 2013). Only a few tin objects were recovered from hoards, such as those from Mochlos (Soles 2004; Berger *et al.* forthcoming), Crete or different locations in Romania (Boroffka *et al.* 2016). In addition two ring-shaped pieces are known from Sweden (Ling *et al.* 2014, 111 Nr. 53. 60). The find contexts suggest that tin ingots were traded and intended to be alloyed with copper. The increasing number of tin finds from the Late Bronze Age indicates a greater demand for tin and/or technological changes (direct smelting of tin instead of co-smelting and cementation).

Tin deposits and mining evidence

Early tin bronze was almost entirely used to manufacture prestige objects, suggesting that it was a highly valued and difficult to obtain raw material. But how and from where was it obtained? In contrast to arsenic, tin does not regularly occur together with copper in polymetallic ore sources. Furthermore, there is only limited chemical evidence, that such ores were used to produce tin bronze (Nezafati *et al.* 2009; Radivojević *et al.* 2013). This is probably due to the difficulty to predict the tin content of the alloy produced from such ores and to control its properties.

An intentional mixing of copper and tin seems to be more plausible. This was probably achieved by adding cassiterite, the major tin mineral, to copper or copper minerals in pyrometallurgical processes known as cementation and co-smelting. Cassiterite could be mined ('lode deposits') or panned from rivers and watersides ('placer deposits').

Tin sources are rare and unequally distributed in Eurasia. Occurrences in Anatolia (Yener 2008; Yalçın and Özbil 2009;

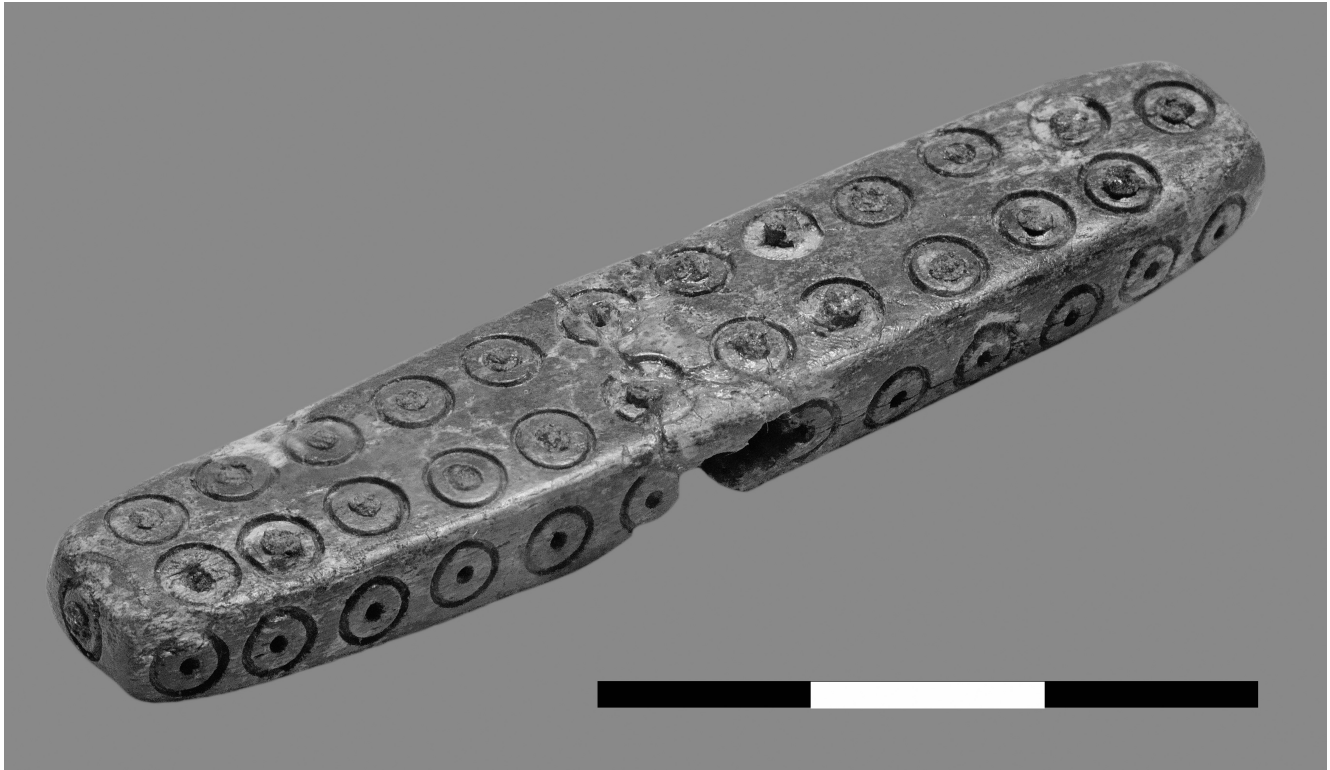


Figure 5.2 Bone object with tin pins from Poing, Germany (© Archäologische Staatssammlung, München, photo: St Friedrich)

Yener *et al.* 2015), Serbia/Macedonia (McGeehan-Liritzis and Taylor 1987; Durman 1997; Huska *et al.* 2014; Mason *et al.* 2016), Slovakia (Schalk 1998), Romania (Boroffka *et al.* 2016), Sardinia (Benvenuti *et al.* 2003; Lo Schiavo 2003), France (Abraham 2011; Cauuet *et al.* 2013), Ireland (Mathur *et al.* 2017), and Egypt (Cleuziou and Berthoud 1982) were mentioned in the archaeological literature. Most of these are rather small and were often considered as potential tin suppliers only due to an early appearance of tin bronzes in the same region. Similar suggestions were made for the Caucasus, Turkmenistan and Iran (Helwing 2009). The notion that these sources were exploited in the Bronze Age is in part based on written documents. But to identify local prehistoric tin exploitation, it is important that contemporary mining operations can be documented, which in most instances is not the case. In the following, only larger sources with documented Bronze Age mining activities are discussed.

Several potential tin mines in the Near East and Central Asia have been investigated in the last twenty years. At the Kestel mine in Anatolia there are both minor gold and cassiterite occurrences. Although it is clear that exploitation began in the Early Bronze Age around 3000 BC, and that ore was processed in the nearby Göltepe mining settlement (Yener 2000; 2008), the character and importance of the Kestel mining operations are still in dispute (*e.g.* Yener *et al.* 1993; 2015; Muhly 1993; Pernicka 1990). The polymetallic copper mine of Deh Hosein in Iran was used in the Bronze

Age as indicated by radiocarbon dates. The local rock has stannite inclusions and cassiterite is found in nearby rivers. Lead isotope analysis suggests that copper from Deh Hosein was used in many Luristan bronzes from the 2nd millennium BC (Nezafati *et al.* 2006; 2009).

Polymetallic ore sources in western Afghanistan were possibly mined in the Bronze Age (Thomalsky *et al.* 2013). A tin source is located at a distance of approximately 500 m from a copper mine in Misgaran with clear evidence of ancient mining activities. Precise dates from Misgaran are currently not available, but tin is also panned today from tin bearing sands in the neighbouring Sarkar Valley (Stech and Piggot 1986; Parzinger and Boroffka 2003).

Several tin mines with obvious Bronze Age mining have recently been investigated in Central Asia (Garner 2013). The region is an important contact zone between the Middle East, Western Asia and the Eurasian steppes. Eastern Kazakhstan has deposits of cassiterite associated with gold. Besides finds of mining equipment and neighbouring settlements, rich burials characterise the local archaeological landscape (Cierny *et al.* 2005; Stöllner *et al.* 2013). The Uzbek mine at Karnab contains cassiterite veins bound to granite. Their exploitation in prehistoric times is indicated by characteristic stone tools, Bronze Age pottery and radiocarbon dating of an adjacent settlement (Parzinger and Boroffka 2003). The Mushiston mine in Tajikistan is much more difficult to access since it is located at a high altitude

in the Ghissar mountain range. Exceptionally, the major ore mineral there is stannite, a sulfide mineral containing copper, iron and tin. In the oxidised zone, malachite and yellow hydrous tin oxides are easily recognised and can be collected on the mountain surface. Radiocarbon dates from a close by settlement indicate Early Bronze Age exploitation (Cierny *et al.* 2005; Parzinger and Boroffka 2003).

Currently, the tin sources in Cornwall, Brittany, the Erzgebirge and on the Iberian Peninsula seem to be the most likely suppliers of tin for Central Europe in the Bronze Age. Cornwall and Devon have some of the largest placer deposits of tin and gold in Europe. Bronze Age production is confirmed by tin-containing slag and cassiterite remains (Fox 1957; Tylecote *et al.* 1989). Britannia was mentioned by Herodot (490/480–424 BC) as one of the ‘Cassiterides’ (tin islands) (Strabo 2005), and extensive tin production is documented from medieval times. Large tin placers of the same type are also known from Brittany. Tin extraction is known from medieval and modern times. Bronze Age mining is likely but not proven (Haustein *et al.* 2010).

The tin province of the Erzgebirge is the third largest in Europe. Although archaeological evidence is still lacking, Bronze Age exploitation of the placers is possible (Bartelheim and Niederschlag 1998), but only medieval mining is confirmed.

The Iberian Peninsula has many small tin deposits in Portugal and Spain. St Cristóbal Mountain in the Extremadura, Spain has evidence of Bronze Age mining and smelting activities (Rodríguez Díaz *et al.* 2001). The exposed granite Mountain carries quartz veins with inclusions of cassiterite. Recent excavations uncovered tools and mining traces dating to at least the late phase of the Bronze Age. The gold treasure of Berzocana was found in the vicinity of St Cristóbal and the mountain might be connected with the legendary Kingdom of Tartessos (9th–6th century BC), which is mentioned by Herodot and Rufius Festus Avienus, who quotes an unknown source from the 6th century BC, as very rich in metal (Sos Baynat 1967; Merideth 1998a; 1998b; Montero Ruiz 2010; Rodríguez Díaz *et al.* 2013). Although large tin deposits are known from northern and central Portugal, their exploitation is as yet only confirmed for the Roman period (Comendador *et al.* 2015).

Determination of the isotopic composition of Sn in tin ores and bronze artefacts

The provenance of tin in prehistoric bronzes is still an unsolved issue, but the isotopic composition of tin itself, in its ores and alloys, may be a promising tool for answering this open question. Therefore, the tin isotopic composition has been determined in Eurasian artefacts made of tin-bronze and in cassiterite from tin deposits in southern England and the Erzgebirge.

One of the main challenges was the preparation and reproducible decomposition of tin ores. Cassiterite as the

main tin ore is highly resistant to most chemicals and cannot be readily dissolved in acids and bases. Therefore, several methods of decomposition by reduction of the oxide to tin metal have been reported in the literature: (1) Chemical reduction with various salts (Hall 1980); (2) Thermal reduction with carbon/carbon monoxide (Rapp 1977; Clayton *et al.* 2002); (3) Thermal reduction with potassium cyanide (Haustein *et al.* 2010). Recently, Berger *et al.* (2017) re-evaluated these methods and investigated in detail the potential loss of tin and its impact on the isotopic composition. Tin loss due to the formation and escape of volatile stannous oxide (SnO) during the reduction is a serious challenge in tin pyrometallurgy (Zhang *et al.* 2015). Moreover, tin is easily slagged by silicates (always present in tin ores) which can result in considerable tin loss, too. Both processes would hamper the use of the tin isotopic composition as a provenance tool, since any loss of tin during the decomposition of cassiterite or during the metallurgical process would cause a mass dependent fractionation of the tin isotopes thereby changing the isotopic ratios (Berger *et al.* 2018).

The systematic experiments of Berger *et al.* (2017) considered synthetic and natural cassiterite and reduced the oxide in a CO containing atmosphere or with different additives such as KCN, Na₂CO₃, Cu and CuO. After analysis of a large number of samples obtained from these experiments, reduction with KCN turned out as the most appropriate method for the characterisation of tin ores, because no fractionation of the tin isotopes as a consequence of the reduction procedure was recognised.

The routine reduction of cassiterite samples was performed in polished graphite plates. Sample material (*c.* 10 mg) was loaded into drilled pits with KCN as an additive. The graphite plates were put into corundum crucibles and embedded in active carbon. The whole assemblage was heated to 1000°C for several hours in a muffle furnace.

The reduction yielded tin beads which were dissolved in a mixture of HCl and H₂O₂ similar to the bronze alloys of the archaeological artefacts. The solution of the tin metal could be directly measured after appropriate dilution with H₂O and HNO₃. However, the bronze solution, containing large amounts of Cu and other metals (Pb, Sb, As, Ag, *etc.*) had to be cleaned chromatographically in order to minimise matrix effects and to avoid isobaric interferences during isotope measurements (Brügmann *et al.* 2017).

The tin isotopic analyses were performed with a Thermo Scientific Neptune Plus MC-ICP-MS equipped with nine faraday cups. Tin has ten isotopes covering a mass range of 12 amu between masses 112 and 124. The measurement of the seven high mass-tin isotopes (¹¹⁶Sn, ¹¹⁷Sn, ¹¹⁸Sn, ¹¹⁹Sn, ¹²⁰Sn, ¹²²Sn, ¹²⁴Sn) was preferred, because they have the highest abundances which help to obtain data with the highest analytical precision. This mass range also fits more closely to that of antimony (¹²¹Sb–¹²³Sb) which was used

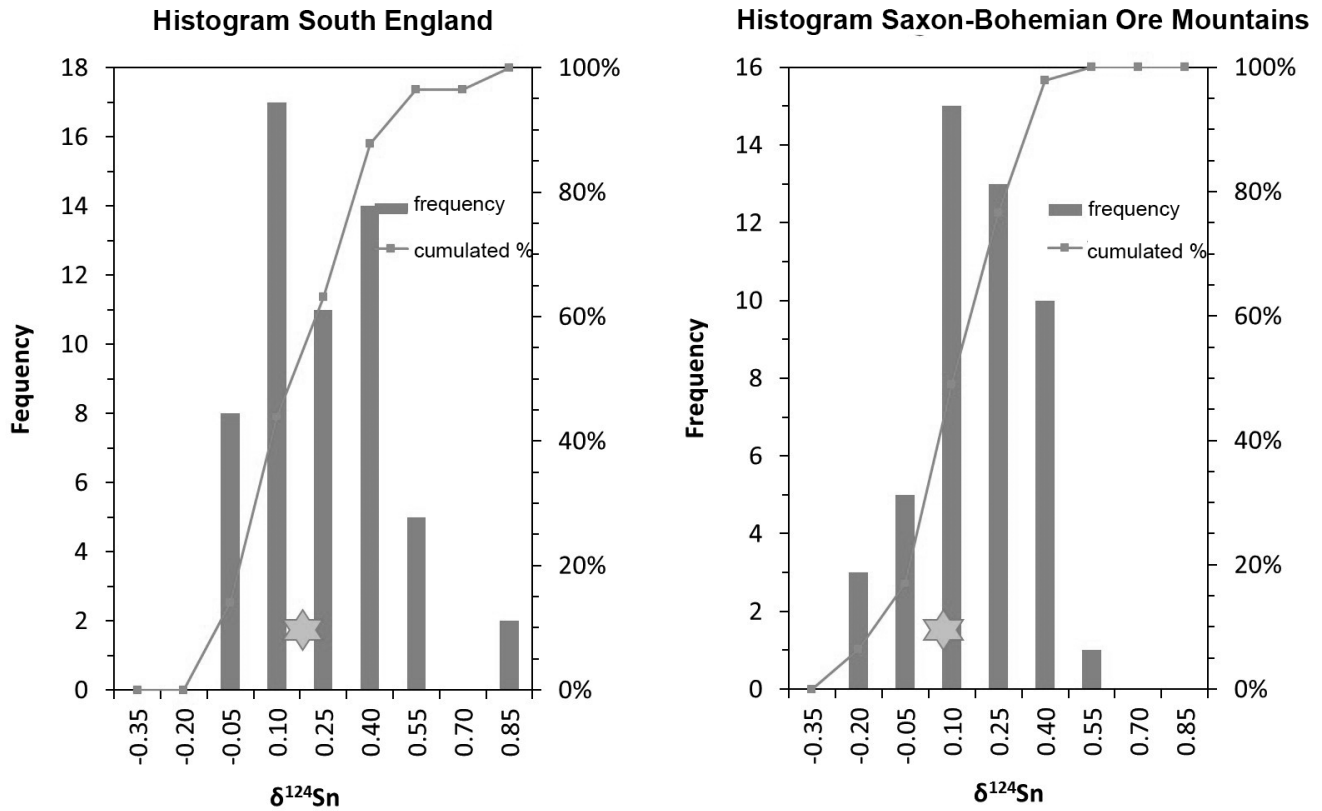


Figure 5.3 Frequency diagrams of the $\delta^{124}\text{Sn}$ ratio in cassiterite from southern England (Cornwall and Devon) and the Saxony-Bohemian Ore Mountains (Germany, Czech Republic). Note the on average heavier isotopic composition in cassiterite from England compared to that from the Saxony-Bohemian Ore Mountains. Yellow stars represent the average values of the populations

for mass bias correction. Samples were run in a blank-standard-blank-sample-blank-standard bracketing setup. The calculation of the isotope ratios, the mass bias correction using the exponential law (Russell *et al.* 1978; Baxter *et al.* 2006) and δ value calculations were performed off-line with Excel spreadsheets. The data will be given with the conventional delta notation where

$$\delta^{124/120}\text{Sn} = \left(\frac{\left[\frac{^{124}\text{Sn}}{^{120}\text{Sn}} \right]_{\text{sample}}}{\left[\frac{^{124}\text{Sn}}{^{120}\text{Sn}} \right]_{\text{Standard}}} - 1 \right) * 1000$$

Although ratios such as $\delta^{124/116}\text{Sn}$ will yield larger values because of the larger mass fractionation, the $\delta^{124/120}\text{Sn}$ values presented below are more precise and accurate, because of minimal systematic errors on the correction for mass fractionation. The combined uncertainty (reproducibility) of the measurements ascertained by repeated preparations and analyses of reference materials amounts ± 0.025 ‰ for $\delta^{124/120}\text{Sn}$ (Brüggemann *et al.* 2017).

Tin isotopic variation in tin ores: Southwest England and the Saxony-Bohemian Erzgebirge

A common feature of the European tin ore provinces is their association with late Variscan granites. The primary mineralisation occurs in pegmatites, greisen as well as hydrothermal quartz and polymetallic veins. The chief tin mineral exploited was cassiterite (SnO_2), but stannite ($\text{Cu}_2\text{FeSnS}_4$) might have been of local importance in the past, too. Cassiterite is a hard and dense mineral that is highly resistant to weathering. During the erosion of the granite the mineral is deposited and concentrated in fluvial placer deposits. These placers are considered as the major tin source in antiquity since high purity cassiterite could be obtained with comparatively little effort.

The tin mineralisation in southwest England (Cornwall and Devon) is associated with a series of granite plutons which intruded during the Upper Carboniferous–Lower Permian *c.* 290–270 million years ago (Chen *et al.* 1993; Chesley *et al.* 1993). We determined the tin isotopic composition of cassiterite samples from pegmatitic and hydrothermal mineralisation associated with the major granite plutons of southern England. The Central European tin province (Germany, Czech Republic) is part of the Saxo-Thuringian

Zone, which belongs to the easternmost part of the European Variscan belt. The late-orogenic to post-orogenic extensive silicic plutonic and volcanic activity at 330–290 million years was the foundation of the wealth of mineral deposits in this area, including the tin mineralisation. We analysed cassiterite samples from deposits in Germany and the Czech Republic (Fichtelgebirge, the Saxon-Bohemian Erzgebirge, Vogtland, Kaiserwald) and re-evaluated and extended the previous study of Haustein *et al.* (2010).

Overall the samples from both tin provinces show a very large range of isotopic compositions and the $\delta^{124/120}\text{Sn}$ values range from -0.28 to 0.85 ‰ (Figure 5.3/Colour Figure 5.3). Although Haustein *et al.* (2010) did not measure this isotope ratio comparison of their $\delta^{122/116}\text{Sn}$ values with the new data indicate a generally similar variation. The average $\delta^{124/120}\text{Sn}$ values for Cornwall and Devon (0.18 ‰) and the Saxony-Bohemian Ore Mountains (0.09 ‰) indicate that the isotopic composition of cassiterite from the Saxony-Bohemian Erzgebirge is on average lighter than that of southern England. This is reflected in the higher proportion of low $\delta^{124/120}\text{Sn}$ values (<0.05 ‰) in samples from the Saxony-Bohemian Erzgebirge, but a higher proportion of

heavy isotope compositions in cassiterite from Cornwall (>0.55 ‰) (Figure 5.3). The isotopic composition of cassiterite from pegmatites and hydrothermal veins overlap and it is not possible to differentiate among different ore types. Large isotope variations occur even in individual ore districts, which in detail, however, display subtle differences.

Tin isotopic composition in Early Bronze Age artefacts from Central Europe and Mesopotamia

Bronzes from the Únětice culture in Central Germany

When tin metallurgy was established or adopted within the area of the Únětice culture and where the technological knowledge was developed is still a matter of debate (Müller 2002, 276–77; Schwenzer 2002; 2004, 236–45; Rassmann 2005, 463–64). Lutz and Pernicka (2010) showed that import of raw copper from mines in the eastern Alps is highly likely. Whether tin was also imported or the people of the Únětice culture mined it in the Saxony-Bohemian Erzgebirge or the Slovakian ore mountains is currently discussed.

Most Únětice bronzes are found in graves and hoards, which contain several hundred objects in some cases.

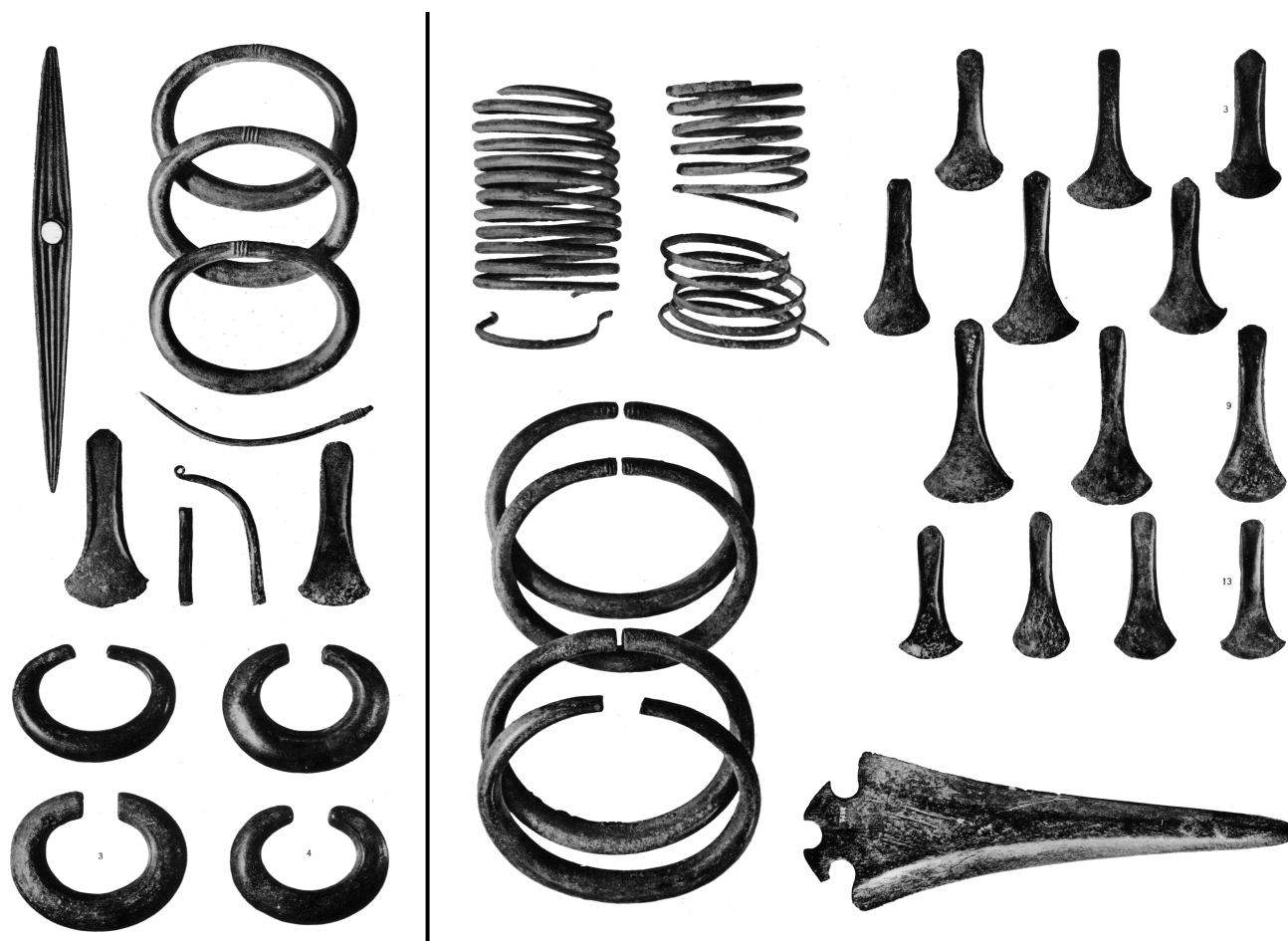


Figure 5.4 Early Bronze Age hoards of Kanena II and III, Germany (after v. Brunn 1959)

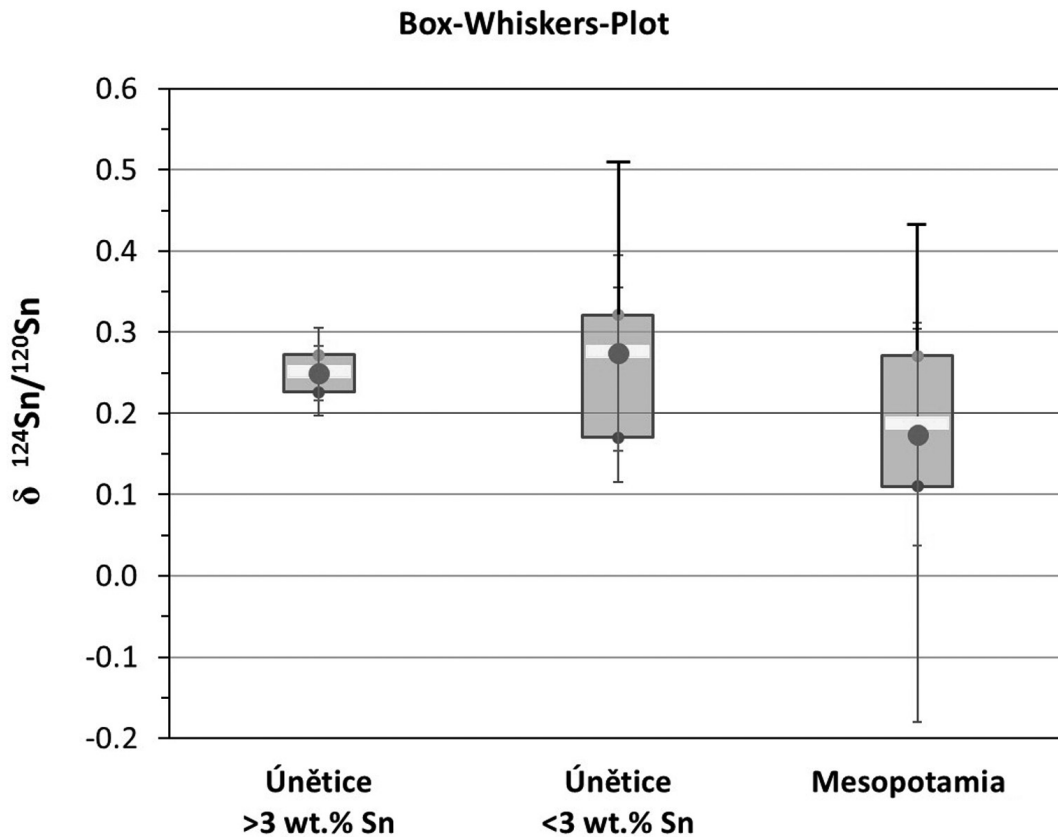


Figure 5.5 Box-Whiskers diagram showing the variation of the $\delta^{124}\text{Sn}/^{120}\text{Sn}$ ratio in EBA bronze objects belonging to the Únětice culture in Central Germany and to the Early Dynastic III and the Akkadian Periods of Mesopotamia. Yellow lines represent the median value, blue dots the average of the isotope distributions.

For our study we chose central German bronzes from the Gröbers-Bennwitz hoard (v. Brunn 1956, 57), which consists of 293 axes, and the Dieskau II and III hoards (v. Brunn 1956, 55–56). The latter contains different artefact types such as weapons, tools and jewellery, as well as amber (Dieskau III). Additional analyses considered items of the Schkopau, and Kanena II and III hoards including weapons and tools (flanged axes, double axes and daggers), as well as jewellery (arm- and footrings) (Figure 5.4). The hoards were deposited between 2100 and 1700 BC (Rassmann 2010, 809–12) and show a highly variable tin content that ranges from 0.11 to 14.4 wt %. Lutz and Pernicka (2010), who systematically studied the composition of these metal finds, estimated that about 90% of the bronze artefacts, especially those of the Dieskau II and III, Kanena II and III and Schkopau hoards, were made from fahlore copper. Such metal is characterised by high concentrations of arsenic and antimony (>1 wt %) and about 1 wt % silver. In contrast, the objects from the hoards of Gröbers-Bennwitz and Burgstaden have systematically lower antimony and silver contents (<1 wt %). These differences indicate that another copper ore type was used, probably one which was dominated by chalcopyrite.

The $\delta^{124}/^{120}\text{Sn}$ ratios in the Únětice objects vary from 0.12 to 0.51 ‰ (Figure 5.5/Colour Figure 5.5). No significant difference can be observed among objects from the different hoards. Thus, the isotopic composition does not depend on the type of copper ore (fahlore or chalcopyrite). In addition, the isotopic composition cannot discriminate between objects with different functions (jewellery, weapon, tools, and ingots). However, this large range of isotopic compositions is only observed in bronze objects with tin contents below 3 wt % (Figure 5.5). Tin bronzes having more than 3 wt % tin have on average a similar isotopic composition as low tin bronzes, but the variation of $\delta^{124}/^{120}\text{Sn}$ is significantly smaller ranging just from 0.2 to 0.31 ‰ (Figure 5.5). Since an intentional addition of less than 3 wt % of tin is not functional due to the small impact on the mechanical and optical properties of copper (Berger 2012), it appears likely that the low tin content derives from natural impurities of the copper ores. In contrast, tin contents above 3 wt % tin perceptibly improves the casting characteristics of the copper and produces a harder but malleable alloy with a golden colour (Berger 2012, 24–26). This change in properties justifies an intentional alloying of tin with copper. Low tin concentrations could also be

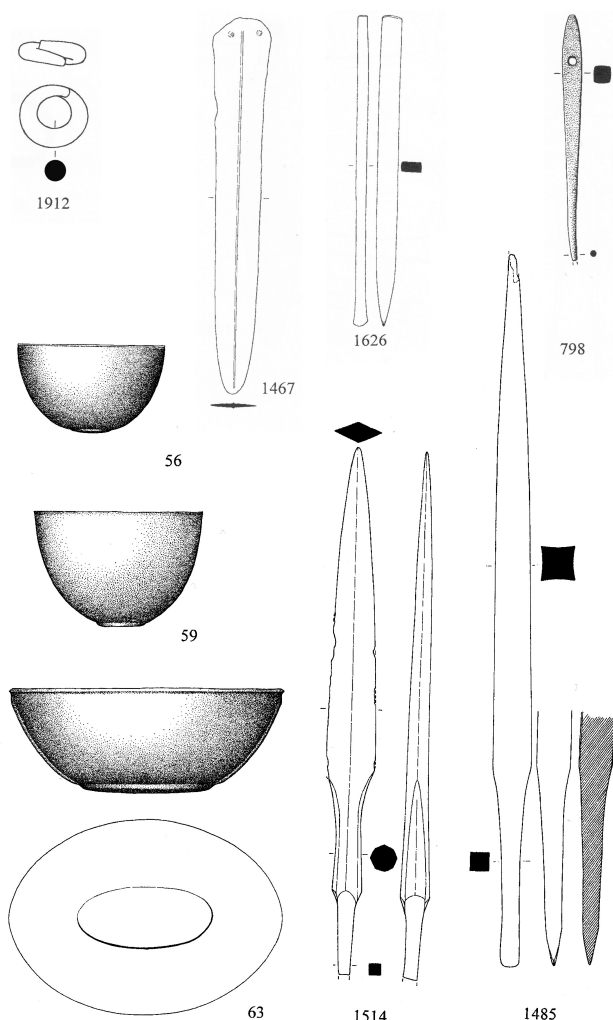


Figure 5.6 Tin isotopic investigated bronzes from Ur, Tell es-Suleimeh and the 'Abu Hoard', Tell Asmar (after Zettler 1998, 24, fig. 25)

interpreted as mixing and re-use of metal with different or no tin contents. However, in such a scenario one would expect a tendency towards homogenisation of the chemical and isotope compositions while the opposite is observed. Another possible explanation would be constant recycling of local bronzes which would lower the tin concentration but would not alter the chemical composition significantly otherwise. However, this is an even less likely scenario, because it requires that only objects with a certain tin isotope ratio were re-melted and not mixed otherwise, which is highly unlikely. Furthermore, since such a loss of tin by volatilisation would tend to move all tin isotope ratios towards higher values of $\delta^{124/120}\text{Sn}$ this is again not confirmed by the measurements of the artefacts.

The uniform isotopic composition of the high-tin bronze artefacts further implies that the tin added to the copper was also rather homogeneous. Even if one assumes a European tin source for the high-tin bronze objects of the Únětice culture, its origin can not be explicitly defined. This is due to the large overlap of the isotopic compositions of the tin ores

from southern England and Central Germany as discussed above. On average the $\delta^{124/120}\text{Sn}$ ratios in the Únětice objects are higher than those of the two ore provinces (Figure 5.5). The high-tin bronze objects have even higher ratios than most of the ores from the Erzgebirge (c. 70%). This would imply that this province is not a likely source of Únětice tin. Without concrete evidence, for example an archaeological context that would suggest a link to the Erzgebirge, southern England is the more likely tin source for the Únětice metal industry at present, because the distribution of isotopic composition in ores and artefacts share a large proportion of isotope ratios.

Bronzes from Mesopotamia

The studied artefacts from Mesopotamia belong to the Early Dynastic III and the early Akkadian period (2600–2200/2150 BC). The objects are predominantly from rich graves of Ur, Kish and Tell es-Suleimeh as well as from the 'Abu-hoard' of Tell Asmar (Müller-Karpe 2004, 5). The sample set includes weapons (mostly shaft-hole axes, spear heads and daggers), jewellery (mostly pins), as well as metal vessels

(bowls) (Figure 5.6). Another 14 bronzes come from Tell settlements in Tepe Gawra, Nippur and Tell es-Suleimeh.

The Mesopotamian objects contain 3.5–17.2 wt % of tin, which has been added as metal (alloying with copper) or cassiterite (cementation or co-smelting with copper/copper ores). The variation of the tin isotopic composition in the bronze artefacts is significantly larger than that of the Únětice culture. The $\delta^{124/120}\text{Sn}$ ratios extend in particular to lighter isotopic composition (–0.18 ‰) with a maximum of 0.44 ‰ (Figure 5.5). The large variation is also a characteristic of individual finds. On average, however, the heavier isotopic composition dominates among the Mesopotamian objects, as suggested by median $\delta^{124/120}\text{Sn}$ ratios of 0.19 ‰ (Figure 5.5). Based on these analyses it is currently not possible to determine the tin provenance of the Mesopotamian objects. The main reason is the lack of isotope data for potential tin ore sources in Central Asia. This is accounted for in ongoing research.

Conclusions

It is evident that tin bronze technology was adopted and established along different trajectories in the Near East and Europe. In the Near East, it is particularly linked to early cities and their administration. An elite-controlled long-distance trade network guaranteed the procurement of raw materials, which simultaneously formed the basis for specialised metal workers and other craftsmen (Pare 2000, 25). In contrast, Bronze Age Europe had numerous local centres without highly developed administration, which only influenced small geographic areas. Here certain ‘hot zones’ in south England, central Germany, northern Italy as well as and northeastern and southwestern Spain appeared, where the tin bronze technology might have been introduced earlier than in other regions. Each of these ‘hot zones’ has nearby tin deposits, whereas every centre in the Near East was dependent on long-distance trade of raw materials.

Tin bronze metallurgy may have been introduced and disseminated over the Near East and Europe from several different places and in different ways. In the Near East, the direction of the diffusion of tin bronze metallurgy is difficult to determine because of the long chronological stages in the 3rd millennium BC, and the slow typological development of bronzes, which makes it hard to distinguish early from more developed technological stages. Moreover, the possible importance of Anatolia for the transfer of technology in northern and southern directions can not be precisely determined. The same applies for connections between the North Pontic region and the Caucasus with Anatolia and the Near East. Neither the present set of tin isotopic analyses of ores nor of the archaeological objects allow a determination of the tin sources used to manufacture Mesopotamian bronzes from the second half of the 3rd millennium BC. The data show a large variation in $\delta^{124/120}\text{Sn}$ ratios, which

means that several tin deposits could be possible sources. However, ongoing analyses of Central Asian tin deposits might help to resolve this question.

In Europe, the following scenario might have taken place: tin metallurgy was introduced to the coastal regions of continental Europe, northwestern Europe and southern England. This is likely since the oldest European bronzes occur in particular in these regions in considerable numbers (e.g. Rassmann 2010, fig. 11). Besides finds of Atlantic bronzes in central European burials, tin isotope analysis of the Sky Disc of Nebra also indicates a connection between Cornwall and Central Europe in the developed phase of the Early Bronze Age (Haustein *et al.* 2010; Nessel *et al.* 2015).

It is impossible to determine the provenance of Únětice tin. Although the exploitation of a European tin source is highly likely, it is difficult to distinguish the large tin provinces in Cornwall and the Erzgebirge isotopically because of a significant data overlap. The isotopic values of many Central European bronzes plot into this overlapping range, which may indicate that more than one tin source were used simultaneously.

Tin deposits in Brittany might have supplied France and the western Alpine region fairly easily by river and coastal routes. Metallurgists of the Iberian Peninsula probably used local tin sources, but tin bronze metallurgy is only dominant there in the second half of the 2nd millennium. The tin bronzes in the Carpathian Basin and around the Balkans, however, seem to be influenced by the Únětice culture and related groups. A technological transfer via the Danube seems to be plausible. An intensive use of bronze is only recognisable after 1800 BC in this region. Several early bronzes found in the area have strong typological connections to the Únětice culture.

There are two current models describing the introduction and dissemination of tin bronze metallurgy: the first acknowledges the diffusion of technology as both an engine and a result of a series of elite exchange networks, where the participants use tin bronzes to express their identity and power (e.g. Shennan 1986). In this context, Early Bronze Age ‘proto-urban central places’, such as tell settlements in the Carpathian basin, fortified settlements of Mad'arovce culture or Únětice culture hilltop settlements are supposed to represent technological centres (Vladár 1977; Jockenhövel 1990; Hänsel 1996; 2002; David 1998; Müller 2002; Bertemes 2004; Gogâltan 2005; Uhnér 2012). From these central settlements, elites controlled and had access to trade in tin and other goods, and they could use this power position to either directly control attached craftsmen or indirectly by restricting their access to raw metal.

An alternative model argues that societies were less stratified. Therefore the pursuit of a craft is primarily linked to affiliation with particular groups in society. Individuals are linked in networks on the basis of common descent (Kienlin 2010; 2012). Their connection is manifested by

feasts, gifts and exchange. Especially ensembles made from the same metal charge (Pernicka 2013; Pernicka *et al.* 2016), such as the representative warrior equipment from the Apa and Hajdúsámson hoards, could be examples of such gifts. It is also important to consider networks based on marriage within kinship societies. Recent studies from Únětice culture burials, as well as from the Early Bronze Age in southern Germany and Scandinavia show the mobility of individual women, which supports such interpretations (Stockhammer *et al.* 2015; *e.g.* Frei *et al.* 2015).

Dissemination of tin metallurgy could have been transmitted orally and by practical participation within descent groups or groups of craftsmen with communal identity. Communication at this lower level of society is highly likely, as only craftsmen possessed the necessary background knowledge to implement the new technology. Knowledge and the ability to identify and determine the quality of new materials, such as cassiterite, are certainly anchored at the craftsmen level.

After a brief introduction phase in which initial experiments with the new alloy were carried out, and basic knowledge and work sequences were mastered by the metalworkers, tin metallurgy was embedded in the societies at large. Elites or kinship groups involved themselves in the exchange of tin and copper, and a communication system was created which not only allowed dissemination of tin bronze technology, but also its acceptance. Knowledge was transmitted by individuals or groups, which explains why it took about 500 years from the first appearance of tin bronzes until a widespread distribution and use in the Near East and Europe.

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Part 2

Prestige economies and exchange

Chapter 6

Unequal exchange and the articulation of modes of re-production

Michael Rowlands

Introduction

I will assume, in this chapter, that the origin of metals in Euroasia bears many of the characteristics of the extraction of fossil fuels for the stimulus of the Industrial Revolution in Europe. By this I mean early metals were forms of biophysical resources that to be extracted, required use of human labour and non-human energy. As complex substances, their extraction and use, in some cases, led to an increase in human energy directed to appropriating increasing amounts of the biophysical resources required as productive inputs. Whilst the consequences of these earlier forms of extraction of natural resources may not be comparable to contemporary dependence on large-scale availability of cheap fossil-fuel energy, how we conceptualise the nature of dependence bears some striking regularities (*cf.* Hornborg 2018). We could even extend the analogue back in time to ideas of early ‘domestication’ that also privilege the input of labour power into transforming natural resources into social value. Given that resources in metals were scarce, gaining access to them also involved mobility and transport which provided opportunities for exploitation through a transfer of surplus value. The use of general concepts, such as exchange or trade, by focusing only on exchange value, I will argue, obscures the role of labour, land, materials and transport as essential conditions for different forms of exploitation converting natural substances into social value. This is compatible with Marx’s critique of ‘free trade’ (such as his critique of David Ricardo’s principle of comparative advantage or would have been later of the marginalist economics revolution of the 1870s) as functioning to obscure the real conditions of exploitation and wealth accumulation by pretending that all the partners will profit through the idea of the ‘self-regulating market’.

In this chapter, I will argue that a focus on exchange alone assumes that the circulation of goods forms a sufficient basis for the creation of value. This means accepting the underlying assumption of the universality of exchange value in converting potentially all things into commodities. To argue that land, labour, materials and knowledge all form part of the underlying conditions of value, as in classic Marxist theory, assumes instead the calculation of different values of labour as the source of surplus value, extraction of which forms the basis for developing a theory of unequal exchange and exploitation. This is also compatible with the proposition by world-systems analysts that unequal exchange can be defined as the ‘constant flow of surplus-value from the producers of peripheral products to the producers of core-like products’ (Wallerstein 2004, 28). Yet, there are also significant problems with the basic Marxist argument that the labour theory of value alone can account for the derivation of exchange value from inputs of labour energy. We may well be still short of the objective of a de-colonised concept of exchange, failing to expose that certain assumptions about the cultural foundations of the ‘market’ are still at work in our assumptions.

My concern in this chapter is to survey the different approaches to use and exchange values and expose the conditions in which we continue to conceptualise forms of exploitation and accumulation or, more often, fail to do so. Ideologically the conversion of modern use values to exchange values will involve money, *i.e.* use value is defined by whatever people are willing to spend money on. But this will not apply to non-capitalist systems of exchange, so either a symbolic or some alternative measure of labour value would have to act instead. Historical materialism has struggled with this problem for over a century and a half

so we may only progress, by returning to a survey of what this has achieved so far.

Exchange and accumulation

In Economic Anthropology, it has become almost unchallengeable that exchange is the key process in understanding the creation of value. The theme has been widely explored in Melanesian ethnography with the basic argument that reciprocity, created through exchange, makes partners in transaction. Also, creating ways to delay or disguise reciprocity are thought to ensure their continuation (Mauss 1954 [1925]; Graeber 2014). The constant act of timing, balancing, delaying and exploiting differences in exchange is said to form the basis of accumulation and inequality in both wealth and distinction.

Resolving the formalist versus substantivist debates of the 1970s led to recognition of commodity forms in 'deep pasts' and the advocacy of World Systems theory for long term histories of capitalism (Abu-Lughod 1989; Chase-Dunn and Hall 1997; Frank 1998). Moreover, the recognition that gift and commodity could co-exist was a return to Mauss's basic insight that all economic relations are embedded in moral relations and all of their forms are present in any human society but in unequal and often contradictory relations of dominance (*cf.* Graeber 2014, 67). But this was still part of the debate on the separation of gift from commodity and their evolutionary digression. Whilst the commodity (*i.e.* calculation of profit) would be found within the logic of gift exchange in remote pasts, it was only later recognised as more than a symbolic presence in contemporary forms of capitalist accumulation. Appadurai's (1986) recognition of the interweaving of gift and commodity in modern exchange has provided insights into contemporary flows of goods and modes of wealth accumulation. Key issues revolve around how qualitative values can be transformed into quantitative values through process of transformation from non-market to market transactions, both material and immaterial. Moral evaluations often play a crucial role in such transformations, making plain that social relations incorporated into commodity exchange are basic to all forms of wealth accumulation (*cf.* Graeber 2014).

Graeber, for example, identifies three moral logics underlying all forms of the 'gift' (communism, exchange and hierarchy) by which he means the values that encompass particular forms of production and exchange. Creating cultural difference or boundaries to flows that, through their porosity, allow values in transactions to be realised was first recognised by Nancy Munn (1986) and followed particularly by Mary Helms (1988; 1993). The irony that comparative advantage would only be achieved by confirming the presence of moral values that would encompass economic differences accompanied the recognition that moral evaluation is part of the transformation of qualitative into quantitative value.

The logic of wealth accumulation through the perpetration of 'taking the outside in' obviously only works with creation of the relations of transactions on the borders of artificially created yet moral cultural systems. The basic premise of a debate in an earlier Marxist Anthropology of articulation of modes of production (now largely forgotten) captured this point exactly; as well as the need to recognise that moral evaluations were part of the process of difference. It is why Friedman emphasised modes of re-production rather than production not necessarily as a pre-capitalist form but true of all economic systems that transformed qualitative into quantitative value (Friedman 1976). The idea that production is embedded in a moral value of reproduction allowed a Marxist Anthropology concerned with the articulation of non-capitalist with capitalist economies to recognise that labour was not an absolute value, or could be only when the market had transformed all labour into a single wage form. Elsewhere in space/time it is exchange or hierarchy that condenses labour and relationships into other forms of value and personhood. It was the relative dominance of such forms of qualitative value and how they may be realised into calculations of wealth and accumulation – surplus value possibly – that the articulation of modes of reproduction provided much needed insight into.

Much of this has been forgotten, so we need, in part, to go back to the origins of Mauss on the social embedding of economies and the debates in Marxist Anthropology to understand their contemporary relevance.

Embedding of moral and economic relations

What Mauss meant by saying that objects exchanged as gifts have a spiritual essence is part of a long standing debate in Anthropology (Graeber 2001; Gregory 2015). All would agree that the circulation of gifts creates relationships through reciprocity and the obligation to exchange. Sociality and exchange, it is argued, has a moral precept that is not religious in the spiritual sense. As a consequence, the question of what compels circulation as 'Spirit of the Gift' usually entails the question of inalienability. There is some power in a thing as gift that generates the moral power of the relationship binding person to giver. The power lies in the rights retained by the original owner over the object given and therefore over the recipient who accepts it. In accepting a gift one accepts more than a thing, one accepts the fact that the giver has rights over the receiver. For Mauss there is a power in the given thing that works on the recipient and compels him or her to give in return. Hence the theme of inalienability constitutes identity and the inalienable essence of a human group.

Much here turns on our understanding of 'gift'. While Mauss was right to reject the idea of a 'pure' gift, there is surely a heuristic distinction to be made. Mauss was often explicit that he did, in fact, believe that the essence of the

gift was essentially religious. The gift embodied a spiritual relationship that bound person to thing. In a sense it was an offering as much as a gift. In this, he was following the guide of several 19th century founders of anthropology (*i.e.* Robertson Smith writing on *Religion of the Semites* and Edward Tyler in *Primitive Religion*) that, contra to modern commodity forms of exchange, gifts and their exchange, are forms of the broader category of offerings. There are offerings made explicitly to spirits/divinities/gods in exchange for goods, health and blessing. Offerings are also made out of devotion without expectations and are more emotionally expressive than instrumentally aimed at securing particular ends. In actual instances this distinction may only represent points at either end of a spectrum of offerings. And sacrifice is the most general term used for this spectrum of circulation covering a wide range of meanings related to offerings. So if we envisage gifts and exchange within a broader category of offerings, it is because we accept that Mauss was correct to see the religious or spiritual element of the gift as important. This implies that offerings are part of a wider catch-all phrase of sacrifice.

A standard first assumption in conventional anthropological statements about sacrifice is that it is a kind of suborder of offerings made in a purportedly sacred context involving at least a triangle of agents: the item to be sacrificed, the person or agent making or ordering the sacrifice or on whose behalf it is made (the sacrificer and the sacrifier); and that to which the sacrifice is aimed or destined (typically a god, spirit, or ancestor). It is an easy step from this view to that of the Maussian notions of reciprocity (Hubert and Mauss 1964) but with the elements of obligation (to pay, receive and repay) augmented by emotional qualities. These include fear, love of the divine, but also anger with it, layered by equally strong emotions directed towards other agents in the triangle, sometimes extending intentionally into a violent spectacle. In this lies an implicit idea of the negative idea of possession and dispossession and thence of either negative or positive bargaining or 'exchange'. This sense of pragmatic exchange modifies Hubert and Mauss's (1964) and Durkheim's (1915 [1964]) bi-polarity of sacred and profane. That is to say, is sacrifice only within the sacred domain? Or, as an offering, is it also a transaction between human and spirit with features therefore of the profane domain? So does it have instrumental characteristics, as in the more pragmatic understanding of exchange?

A key feature is that, whatever may be the intentions of the sacrificer and sacrifier, an offering is made to a non-human and divine agent, who may take any form, even rocks or vegetation, as well as transcendent spirit. Clearly excluded from the idea of sacrifice are offerings made by humans to other humans, which are a colloquial extension of the concept (*e.g.* 'I have sacrificed my life to work so that you can go to college'). Whether regarded as balanced, general or gift exchange, sacrifice usually raises

questions about prestations to gods or spirit. Thus, though we are not privy to the intentions of a human sacrificer or sacrifier, we may ask: what does he or she expect from the divine agent in exchange for the sacrifice? Or, does he/she expect nothing and makes the offering out of utterly selfless piety and/or obedience or fear? We touch here on the awkward question of whether any offering can be made which does not presuppose some expectation of return in the manner discussed by Mauss for the gift, bearing in mind his rejection of this possibility (a claim which might seem to apply to exchange between groups much more than between individuals). Yet, looking at sacrifice as an offering, we are given ethnographic claims that it can be made unconditionally and not with the expectation of some return, boon or benefit. The unconditionality of giving (*i.e.* without return) fits within an orthodox Judaeo-Christian-Islamic view. But this is not the case for many of the classic studies such as Evans-Pritchard's study of Nuer sacrifice (Evans-Pritchard 1956). He would say that the Nuer are more concerned with an instrumental notion of sacrifice as a negotiation with a divinity that can be the cause and means to take away sickness, infertility and misfortune which arise when someone commits an offence – adultery, incest or homicide. Or the Nuer make sacrifice to a spirit to make sure that rites of passage, such as initiation, marriage and death, are carried out successfully. They sacrifice to spirit as a way of redeeming and purifying themselves as a community. A contrast is established between expectations of a return in the classic sense of 'spirit of the gift' on which sociality depends on the recognition of debt and reciprocity with those forms of offerings that may be more or less instrumental. Sacrifice without any expectation of a return is therefore one extreme of a more general spectrum of expectations of prestations and offerings in which reciprocity is expected, hoped for or compelled. In the sense that whatever the position on the continuum, the relation between person and thing involves a degree of fusion of shared substances, the contrast with commodities is absolute and distinct. Whilst it is true that our starting point is exchange, we find that it rests on an ideological statement. The separation of gift from commodity, *i.e.* the principle of accumulation of wealth in people in contrast to accumulation of capital as money rests on the principle of being embedded or dis-embedded in forms of social debt. And the principle obscures exploitation, not through exposing a hidden relationship but rather due to the fact that both are embedded in relations of production that, in very different ways, turn out to be social relations of reproduction.

Prestige goods and Marxist Anthropology

In the time of Mauss's writing on the Gift, he like many others conceived the discussion in broadly evolutionary terms. The 'spirit of the gift' characterised archaic societies

in contrast with commodities and the market in modern capitalism. What developed as Substantivist and Formalist debates concluded eventually that such a temporal sequence was empirically unviable? In the 1970s in Anthropology, the situation was resolved in a particularly interesting way by a group of French ethnographers attracted to applying Marxism to their fieldwork (these authors were Ekholm 1977; Meillassoux 1960; 1978; Dupré and Rey 1973; 1980; Rey 1975; 1979; and Terray 1972). Rather than non-capitalist or pre-capitalist economies being backward social forms dissolving in the face of an advancing capitalist mode of production, they showed, in their work in West and Central Africa, that autochthonous societies were reinforced and even expanded through the relationship to the forms of capitalism introduced by European trade and subsequent colonisation.

The French Marxists' major contribution was to develop conceptually one political form of these relations; what they called the lineage mode of production. External alliances became forms of segmentation on which lineage hierarchies are formed and the majority of lineages were made up of people who had been absorbed and converted through the ideology of descent (Meillassoux 1978; Terray 1972). Trapido gives a very clear account of how the lineage mode of production has been largely misrepresented in subsequent critiques of the French Marxists' school (Trapido 2016; 2017). For Rey, the lineage mode of production was the dominant pre-colonial social form in West–Central Africa in which a class of elders was dominant (Rey 1975). Dominance was based on the rights over the labour of others, slaves, women and young unmarried males and not through direct control of the product of their labour (*cf.* Goheen 1996). In Africa, land was plentiful and by giving them a monopoly access to marriage, elders controlled the production of people rather than accumulation through objects for exchange. The basic ideology of lineages, as constructed through acquisition of people and the building of retinues through descent, is taken to be the pre-colonial mode of production that is then violently affected by the encounter with European based capitalism. The idea of encounter and articulation of modes of production is quite different in this respect from World Systems and centre–periphery models. The encounter of two modes of production are recognised to be quite distinct in their historical trajectories and do not involve any mutual dependency. In fact the demands they make on each other are quite distinct and, whilst mutual to some extent, follow quite different logics that are often barely comprehensible to each other. On the principle that some degree of commercial exchange is a long-term feature in history, we may imagine that 'articulation' of a mercantile logic (where money-commodity-money plus occurs) with a pre-capitalist demand for 'prestige goods' (where the logic is non-separation of object from person and *vice versa*) is a fairly constant feature. It is important to recognise that

the accumulation of wealth in people would be different from wealth in money, as a feature that is now so well understood in the prehistory of Africa. But if the logics of the two systems that meet each other and find benefit from the encounter are so different, why is it the interface between them that becomes the site of expansion and transformation?

In contrast to dependency and World Systems theories that tend to emphasise the power of capital to create 'peripheries' suitable to their needs, the French Marxist emphasis on articulation allowed not only a focus on historically variable encounters between distinct modes of production but, and this may continue to the present, a greater willingness to recognise that the non-capitalist could resist, may not be assimilated nor be transformed into modern (*i.e.* Western) forms of capital. Instead the encounter could continue to elaborate a logic that was historically of its own making.

Access to prestige goods of European origin, was a crucial feature of this articulation of distinct modes of production. But this did not mean that prestige goods were mere symbols representing status gained by other means. Prestige goods, following the logic of the gift, were the source of the power of lineage elders. To understand why requires an illumination of the crucial argument that in pre- or non-capitalist societies, power was not directly based on the control of surplus value through the exploitation of the productive labour of others. Marx's analysis of capitalism in which the accumulation of wealth depended on direct extraction of surplus value from the labour of others, stored as money in mobile forms of capital was, they argued, not relevant for pre or non-capitalist social forms. Rather, in the lineage mode of production, the power of elders depended on control over the reproduction of people on which accumulation of wealth depended. Control of exchange by leaders gave control of the demographic reproduction of the lineage that in subsistence societies, allowed control by elders of the surplus products of both junior women and men (Dupré and Rey 1973; Rey 1979). The influence of both Mauss and Lévi-Strauss can be seen here in the emphasis given to the use of prestige goods in the control of marriage. Prestige goods of foreign origin, when used as bridewealth to monopolise marriage, could be converted by elders into control over the reproductive value of women, their children and their labour. Moreover it was the contact with Europeans and subsequent colonisation by them, that gave elders increased access to mass produced commodities as wealth items on which expansions of polygamous marriages depended. The irony, of course, should be that this offended the Christian morality of missionaries who then campaigned successfully in Africa, against the expansion of polygamous marriages on which the beneficial exploitation and expansion of the lineage mode of production by colonial power depended. The idea that this model of pre-capitalist exploitation was only relevant to Africa (a criticism made

of applying it, for instance, to European Early Iron Age by Frankenstein and Rowlands 1978) forgoes the obvious comparative methodological point that concepts from whatever source are made relevant by the rigour of their interrogation of concepts used elsewhere. Circulation of wealth in things as a means of control of wealth in persons through controlling their reproduction has a very wide relevance both historically and in contemporary settings of outlandish forms of display of wealth and celebrity culture. The 'potlatch' as visible forms of display of wealth attracting retinues of clients and developing patronage networks is far more basic to human modes of exploiting (*i.e.* making the rich visible and singular and the poor homogeneous and invisible) reproduction and leading to direct or indirect control of the value of labour in production.

A crucial issue for the French Marxist Anthropologists was to identify pre-capitalist forms of class exploitation (Rey 1979). Monopolies of access to exchange in bride wealth payments leading to control of marriage and reproduction meant, for them, the identification of class exploitation by lineage elders of women and junior males (the latter being either excluded from marriage and therefore excluded from becoming elders or would depend on elders for the bridewealth needed to get married and, in turn, succeed as an elder). In the debate of the time on whether class could be identified in non-capitalist societies (*contra*, in particular, to Dumont 1980 writing on *Homo Hierarchicus*), the French Marxists undoubtedly over stressed their emphasis on control of marriage through bride wealth payments and forgot to embed this in a wider context of ritual and sacrifice. In the setting of West and Central Africa, these rituals were and still are principally funerary and involve vast expense absorbing more wealth than ever not only to ensure that the souls of the dead become ancestor spirits but also to legitimise the correct succession of juniors to titles of lineage elders.

Themes of fertility and sexuality are prominent in funerary rituals (*cf.* Bloch and Parry 1982). The use made of rites of death and rebirth can either be metaphorical to manage the emotions and feelings that loss and grief inevitably arouse or they emphasise the social in the sense of repairing the damage death makes to social cohesion. The latter, a more Durkheimian perspective, is often stressed in anthropological studies of ritual. For Bloch and Parry, the mediation between these two perspectives lay in the association of death with the renewal of fertility and the manner in which this 'negates the finality of death' (Leach 1961). Their discussion of how fertility is created 'out of death' is antithetically constituted by the opposition between eternal, stable and life giving elements with those that evoke notions of individuality, biology, exchange and transference (Bloch and Parry 1982, 38). But if this is the ultimate conditionality of reproduction then the essential question who makes the claim to ensure that fertility and

reproduction, inevitability emerging from the trauma of death and rupture, would be for, the French Marxists, the essential basis for resolving the political problem of authority. In the case of India, Bloch and Parry follow the analysis made by Parry of death as a cosmogonic sacrifice locating the ultimate source of regenerative power in the transcendent ritual sphere, that places the Brahmin in the superior position. Studies in Africa by contrast largely relate death to a more pragmatic concern with establishing its cause in human agency most of which stem directly from stresses within the lineage mode of production. Even so, the idea of 'prestige' is relevant only to the extent that some idea of mediation and activation by a particular category of persons is imagined. We may speak of priests or ritual specialists in the sense of the pure in transcendence or more general categories of specialist who intervene in modes of detection such as diviners, healers as well as those capable of wielding violence in justification of apotropaic functions. What the French Marxist anthropologists give us is the insight that production and exchange is not only embedded but the value generated is determined by the larger social totality. The basis of life giving rituals and the bringers of life and fertility relate to the foreign providers of prestige goods in the sense they have the potency of externality to activate the required rituals. Creating strangeness is the way that people promote the efficacy of ritual life and infuse the condition of productivity and reproduction with the certainty and security of care and protection.

Extraversion, dualism and accumulation

But to leave it at that, requires further elaboration of the well-established fact that the origins of prestige goods are usually 'foreign'. Mary Helms is usually cited at this point, to stress the relationship between craft skills, exotic materials and long distance sources of items vital for social reproduction (Helms 1993). Exchange value in the Marxian sense of extraction of surplus value through conversion of goods entails mobility and the possibility of acquiring advantage through exchange. Marx, following a Hegelian view on dialectics, also argued that use and exchange value were always inseparable although one would be dominant (Marx 1970 [1859]). The use/exchange value dialectic only makes sense as long as there is a separation of spheres in which one plays a dominant role. Hence the separation of subsistence from exchange usually constitutes itself as a binary relationship that plays itself out in different modes of circulation and mobility of both persons and things. Also in terms of hierarchy, the one must dominate over the other. In gift economies, for example, many studies have shown how even with the circulation of exchange value with gains of surplus value involved, the spirit of the gift dominates as the value ensuring social reproduction (Damon 1980; 2016). The development of a prestige goods economy, on

the other hand, usually undermines any existing form of hierarchy based on purely ritual conditions of reproduction. Even so degrees of dualism are likely to be quite variable with the separation of the political economic from ritual power often being represented as a spatial separation of centre-periphery form.

The problem with my argument so far, is that the relation of exchange to utility has remained limited to the idea that production lies at the core of social reproduction. But we can complement it by relating to Sahlins' more general argument that all, what he calls, elementary forms of political life, are based on a cosmo-politics that encompasses production and exchange through the conditions of reproduction which creates, as he argues, a hierarchically organised polity 'since the life-giving means of people's existence were supplied by "supernatural" beings of extraordinary powers' (Sahlins 2017, 92). He goes on to distinguish two forms of authority and legitimacy, coexisting in a state of mutual dependency and reciprocal incorporation, described, by him, as the 'native people' and 'foreign rulers' each of which claim precedence on different bases. For the 'native people', it is the founder principle; the right of first occupancy and the claim of autochthony (Sahlins 2008, 183). The claimants of earth cults and their inherent relation to land and fertility give a unique access to the divine. But the stranger-king of foreign origin exercises superior might and the use of violence to establish sovereignty. Yet Sahlins goes on to argue that this complementarity of opposites is already there in the original form of the opposition of external affines to internal consanguines. The incest rule is the basis for his claim that stranger-kings are politically inseparable from the role of affines in elementary forms of kinship and the domestication of alterity. Kinship metaphors are used to articulate the relation of sources of political power to the wild – 'the extraordinary subjects and agents that control the human fate live outside the space of human control' (Sahlins 2008, 184) or 'If humans were immortal', as Viveiros de Castro says, 'perhaps society would be confounded with the cosmos. Since death exists, it is necessary for society to be linked with something outside itself – and that it be linked socially to this exterior' (Viveiros de Castro 1992, 190–91).

But once out of the wild and in power, the stranger-king provides the means of access to life-giving and life-taking; the dark side of kingship, what would otherwise lie beyond human knowledge or control, is harnessed as a kind of creative violence. The important point is that the stranger-king creates new value. In the Hawaiian islands, as described by Sahlins, Captain Cook and later Europeans brought iron and European goods and fertility for women (Sahlins 1985). But they did not remain 'European' but were Hawaiianised (as was Cook's body such that, after his death, those who killed him came to the crew of the *Endeavour* to inquire when he would be returning – *i.e.* reincarnated

as the God Lono). The domestication of foreign value into local forms becomes therefore the basis for establishing comparative advantage and the capacity to enter into alliance and exchange. In the Nordic Bronze Age, binary categories of autochthony, land, fertility, light and amber contrast with stranger-king creative violence, bulls, weapons, and special skills in bronze-working (*cf.* Ling and Rowlands 2015). In central Europe, the Tumulus and Urnfield groupings are the source of both bronze images and weapons, where stranger-kings (who may have been both genders) derived from, and possess specialist craft skills and technologies. The Atlantic West on the other hand is the nexus of the trade in naturalised raw materials, principally metals and amber, possibly wool and textiles. The construction of value is a product of the process of transfer and domestication which in turn is embedded within a wider shared cosmology, in transfers of the conditions of fertility and reproduction; and in very broad terms the well-established themes of Indo-European cosmologies in which kinship denies the role of ancestors and emphasises alliance/affines rather than descent as a significant principle (Rowlands 1980). If stranger-kings have monumental burials, personalised weapons and heroic narratives, the alternative suggests a principle of land, fertility and autochthony where burial would be naturalised (implications of sacred water, ritual burning to produce a sacrificial form of burial and excarnation come to mind).

There is good reason to agree with Sahlins that reliance on the externalities of power that once harnessed and domesticated, can be seen as basic to human social origins (Sahlins 2008). The incest taboo is basic to his argument 'that life is gained from and lost to the outside' and affinal relations' form the archetype to human sociality. Nevertheless, the potency of alterity must appear in many different forms. 'Stranger-kingship is a developed political expression of the same' (Sahlins 2008, 196). But rather than the focus on violence, foreign objects are beneficial agents and those who travel and trade to obtain them and their life enhancing powers gain prestige and also the unequal value of the exchange. Whether we call them shamans, prophets, chiefs, merchants or stranger-kings they share a similar structural authority in their command of external sources of vitality. According to Helms there is a direct relation between this remoteness from the centre and the potency this provides of 'supernatural' power. It is why cosmogonic centredness always appears as lacking any defining boundary. Each outside is also an inside in a sense of contextual opposition relevant to life giving substances and gifts brought in by strangers. 'Certain categories of people', she writes, 'especially affines (in laws) are associated with the cosmographically charged world outside and therefore convey, distinct supernaturally charged qualities associated with the wider cosmos' (Helms 1993, xii). Rather than alterity as 'other', all cosmologies are mixtures of insides and outsides and we should be concentrating on histories

of these interacting ‘traditions’ based on borrowing and its denial (*cf.* Mauss 2006, 57–75).

How do such different conditions of ensuring the ritual reproduction of life relate to demand for ‘prestige goods’? In transcendent world religions, the spiritual is embedded in things that relate to the person in a dichotomous manner of promise and aspiration. The ‘hoped for’ nature of being is materialised in notions of the divine that ensure both reproduction and regeneration of life. Materialising the divine or even the generic notion of the spiritual turns our attention back to sacrifice. Sacrifice attracts and fixes a spirit, that is either deemed to already exist in an invisible form or more often is a made to exist by being activated in a material realm that may be a fixed site or a shrine or mobile objects. That sacrifice animates is the same as saying that as a technique it creates a subject, a living entity that can be channelled to achieve certain ends. I will add that this apparent object-subject relation is dissolved by another technique – activation, *i.e.* by the ways things are conceived as ‘charged’ with ontological potentials of various kinds, *i.e.* given personhood as in frequent descriptions of animism, and how a lot of attention and care (ritual or otherwise) is given to controlling the ways in which these potentials are activated in different ways. I guess the Ur-example here would be consecration (including initiations, baptisms, blessing of lands or crops or seas, creations of talismans or cult objects, wearing of masks, playing of music, dancing and percussion) although the illusions here to anointing or blessing are perhaps better covered with a more general notion of ‘feeding’.

The demand for ‘prestige goods’, whether capitalist or non-capitalist, is answered in the most boring way possible in terms of status and prestige. In the capitalist logic, money is the highest prestige object that determines possible conditions of life. From this perspective, money is the common denominator linking the quantifiable measures of use value and exchange value. According to Marx, it is the monetary difference between maintaining the subsistence of labour power in contrast to the profit created by its input into a productive process that creates surplus value. There are, of course, according to Marx, alternative inputs of use values into the productive process, including land, raw materials, and knowledge/skill creating various combinations of organic composition of capital on which profits can be calculated. But for capital the ultimate object of exchange is the production of money, as in the famous equation $m-c-m+$, and it is money that feeds into the general proposition of what is needed to maintain life, quite literally in aspects of subsistence, health and well-being, as well as what is conceived to be the preservation of a ‘good-life’. Incorporating the ‘social’ into the definition of use value was Marx’s insight into the social relation of production although he did not recognise that money was the basic pecuniary advantage since, for him, extraction of energy in

labour power formed the basis of exploitation. In the sense that the worker exchanges his/her labour time for money, this is a symbolic resonance mostly for the reproduction of a life/lives. As modern studies of consumption show, this is by no means necessarily just about the material conditions of existence but involves satisfying the whole gamut of social needs. Articulated to the non-capitalist logics of either animism or analogism, according to Descola (2013), money as the outcome of his mode of naturalism, is irrelevant when faced with a more immediate proposition that prestige goods as bridewealth or as sacrificial objects or as procreative and protective aspects of ritual life, cannot be realised as money but more overtly is realised in the active potency of the materials themselves in preserving and reproducing life/lives. The argument implicit in the articulation of modes of production was of course to deny a simple binary opposition of these logics but to recognise their entanglement and mutual dependency in a modernising context.

Conclusion

We began by reminding ourselves that metals, in origin, were sources of biophysical energy that, through circulation, disguised unequal transfers of cheap resources for manufactured products. Textiles from temple economies in Southern Mesopotamia being exchanged for copper, tin, silver or lapis lazuli would be matched 3000 years later by exchanges of textiles from England for slaves, palm oil, ivory and gold in West Africa. What disguises the inequalities in exchange is money but not necessarily of the general purpose kind. To some extent this was not absolute. Silver was a generic means of exchange in Mesopotamia and cowries, beads or brass manilas would perform the role of general purpose money in West Africa. But only to a limited extent and usually in order to reinforce monopolies in exchange. In Economic Anthropology, general purpose money is distinguished from special purpose money that can only be used within a restricted sphere of exchange. What this achieved, for Marx, was to understand how access to use values (the desire or need for a particular resource) can be converted from a qualitative value of need to a quantitative value based on labour. But alternatively, the essence of the gift is a form of exchange value that leads to accumulation of wealth in people rather than things, to the extent that one can tell the difference between the two. The idea that prestige is symbolised in goods whose possession simply transfers value from object to person is rendered naïve. Yet what is meant by value remains unclear, in particular the fact that exchange value is often taken to be part of a general political relation articulating exchange whatever form this might take.

But this uncertainty, may lead us to lose the specificity of the Marxian concept of exchange value which makes the transfer of money into commodity into more money pivotal

to the accumulation of capital. An emphasis on control of prestige goods as a means of access to social networks says little more than exchange is the basis for sociality. Instead we have to concentrate on analysing how prestige goods give access to energy, land, labour and materials as use values and therefore different forms of exchange value from that described for capital: and how their qualitative and quantitative values are mediated through monopoly access to prestige goods and in turn, disguised by them. It may well be that this also demonstrates our inability to distinguish completely access based on money and commodities, or through gift exchange as the circulation of social debt or ritual means of symbolic reproduction and the making of life. But that maybe the whole point. They should not be distinguished but identified in how they generate relations of social reproduction in the same setting.

To resolve this methodologically, we have concentrated on resuscitating the work of the French Marxist Anthropologists who were concerned with distinguishing capitalist and non-capitalist forms of class society in long term histories of Africa. By recognising their more general theoretical contribution, we are better able to see how different forms of use and exchange value may articulate with each other to create different forms of accumulation. Both as wealth in capital and wealth in people and their social reproduction, and how they connect and exploit each other for their long term yet separate historical benefit: a dialectic which continues to the present day.

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Chapter 7

Why was (and is) silver sexy? Silver during the 4th–3rd millennia in the Near East and Mesopotamia

Susan Sherratt

Shininess and colour

For some time now I have been thinking about why silver has had the history it has in the Old World – from its first regular appearance in the 4th millennium BC in western Asia, to its adoption by Mesopotamia, in particular, as a standard of value and, indeed, a medium of payment in the 3rd millennium, to a full-blown currency and material for coinage in the 2nd and 1st millennia, and to its continuing role as a medium and symbol of wealth accumulation and storage (as well as of social ostentation) today. In this paper I want to concentrate on the early part of this very long period, and think about silver particularly in the 4th millennium: what it meant to the inhabitants of the newly urbanising centres of Mesopotamia at that time, and has continued to mean, increasingly globally, in a number of respects ever since. As a result, I have been centring my thoughts around a number of questions:

1. What was (and is) the appeal of silver?
2. Why did Mesopotamia, in particular, start to take up silver in such a determined way in the 4th–3rd millennia BC?
3. Why was silver relatively late in appearing on the scene, by comparison, for example, with gold?

Each of these questions has several sub-questions nested within them, and I shall try to raise some of these as I go along.

Let us start with the first one: What was the appeal of silver? Part of the answer is probably the obvious one: silver, like other metals, including copper and gold, is shiny – either bright whitish shiny, like the polished silver we are more accustomed to seeing today, or gleaming black or grey shiny, as it is when left unpolished. The etymologies

of words for silver in some Indo-European languages, at least, seem to confirm this. For instance, the Greek ἄργυρος (from ἀργός), Latin *argentum* and Armenian artsat’ probably come from a Proto-Indo-European root *arg-, rĝi-, whose basic meaning is probably ‘shining, bright, glistening or gleaming’ (Pokorny 1959, 64–65; Frisk 1960, 132–33 s.v. 1. ἀργός and ἄργυρος); and it has been suggested that there might have been a Hittite word from the same root (Hoffner 1968, 41–42; Giorgadze 1988). Something similar may well be the case in Sumerian and Egyptian, which I shall come back to a little later.

Humans, rather as magpies are traditionally supposed to be, were presumably originally attracted to metals – first copper, then gold – by their shiny appearance; and for the first few thousand years or so of metal use they used them almost exclusively for personal ornaments. The people buried in the 5th millennium Varna necropolis on the western coast of the Black Sea made lavish use of gold bodily ornaments to emphasise their personal assets (like the famous gold penis sheath: *e.g.* Slavchev 2010, figs 9–11; *cf.* Renfrew 1986, 148) and no doubt to make them more attractive to potential mates, just as male bower birds use bright colourful and sometime shiny items to make their nests more alluring to females (Gilliard 1956). Silver, I do not need to emphasise, like gold, is a spectacularly *impractical* metal, in the sense that one cannot make functionally useful objects, like tools or weapons, out of it;¹ and this, I suppose, makes it an example of a luxury as opposed to a necessity, in the common vernacular sense of something that is desirable but not indispensable.² In fact, this appears to be precisely the sentiment of the sadly very fragmentary ‘Dispute between silver and copper’, one of a series of later 3rd millennium Sumerian disputation texts, in which copper, who claims to be strong and powerful and to produce abundance by

his labours with his copper hoes, adzes and axes, accuses silver of finding a home only in the palace, without which he would have no existence, of being buried away in the darkest spots of the private home, where men make strong boxes for him, and of being of no use whatsoever when it comes to irrigation, ploughing, cutting firewood or the harvest (Kramer 1963, 265). In other words, silver is a metal for gods, kings and lesser mortals to show off with and to hoard, rather than to do useful things with. As a result it is a metal particularly well suited, in default of any other use, for accumulating and storing wealth (or in other words ‘capital’, whether social, symbolic or ultimately economic), just as it is. Sadly, however, from a purely archaeological point of view, unlike copper and most copper alloys and especially unlike gold, silver often tends to corrode quite badly when left unprotected in the ground for any length of time. This means not only that its forms, when deposited in the ground, are often difficult to reconstruct, but also that its unappealing condition, in the days when excavations were carried out with the primary purpose of recovering visually attractive artefacts for museum collections, sometimes led to it being overlooked or ignored.

Medieval alchemists associated gold with the (yellow) sun, and silver with the moon – an idea that can be traced back as far as the Orphic Hymns of around the 2nd or 1st century BC (*The Hymns of Orpheus* [transl. Taylor] nos. 7 [To the Sun] and 8 [To the Moon]), and that possibly goes considerably further back than this. This could only have happened once silver had joined the regular metal repertoire, and probably only in circumstances where it habitually had a pale, polished rather than darker unpolished surface appearance. This seems to have been the case in both Egypt and Mesopotamia. For example, in Egyptian hieroglyphs the word ‘hedj’, meaning ‘white’ or rather the ‘absence of colour’, along with the determinative for ‘gold’ in the form of a necklace, was used to denote silver, showing that silver was regarded as white or colourless gold (Gardiner 1927, 492, 576, 586, 591). In 3rd millennium Mesopotamia the logogram for silver often includes the sign transliterated by the word ‘babbar’, meaning ‘white’ (KU. BABBAR), which together literally mean ‘white precious/noble metal’ (Joannes 2010, 486–87; Helwing 2014, 417; Warburton 2016, table 1; cf. West 1997, xxi); this adjective, interestingly, was also used for the sun god, Utu, who lived in the ‘white house’ (E. BABBAR) (Black and Green 1992, 184), suggesting that a contrast between golden sun and silver moon was not a concept current at least at that time and in that part of the world (where the sun at the height of the day often appears white).³

However, this brings us to another aspect of metals in general and silver in particular: the importance of colour, and especially of colour contrasts – which, in our ethnocentric utilitarian attitude to metals, which privileges their technological or other capabilities, we sometimes have

a tendency to overlook. The potential for these contrasts, even if not apparent in early Mesopotamian vocabulary, becomes beautifully clear from the silver inlays on arsenical copper swords from the large Late Uruk influenced ‘palatial’ complex at Arslantepe in Central Anatolia, dating to around 3400 BC (Frangipane 1997, 49; Frangipane and Palmieri 1983, 400, figs 58:5, 59:5–6, 62:1). And indeed, it was probably the search for colour variations and contrasts which led to an explosion of experimentation with more complex copper ores and different copper alloys from early in the 4th millennium, as seen most spectacularly in the hoard from Nahal Mishmar in the Judean desert, where alloys of arsenic, antimony and copper, and of arsenic, copper and nickel were used to produce some striking variations in colour of the finished objects (Shalev and Northover 1993; Philip and Rehren 1996, 141).⁴ At Nahal Qanah near Tel Aviv, a hoard of eight ring-like objects, also of 4th millennium date, are made of a mixture of gold and varying proportions of silver (Gopher *et al.* 1990; Philip and Rehren 1996, 140–41). Although they may, from their faceted, unfinished appearance, have been intended as ingots rather than ornaments, it also seems likely that their composition was deliberately manipulated to produce particular surface colours.

The 4th–3rd millennia: Mesopotamia’s love affair with silver

Silver was relatively late in appearing on the scene, probably because native silver is particularly rare and because it took some time to work out how to produce it by cupellation from lead ores, so that, unlike copper or even to some extent gold, this gave it a certain appeal of novelty in the 4th millennium. In addition, copper by this time was increasingly used for tools (the casting of heavy copper tools, including shaft-hole tools, had been around since the earlier 5th millennium; Sagona and Zimansky 2009, 139),⁵ implying that not only was copper ubiquitous by the 4th millennium, but it had lost much of the perception as a metal for ornaments, for social display and for exchange rather than practical use, which it undoubtedly had when it initially started. With the exception of a few silver ornaments, such as three silver beads from 6th millennium Domuztepe in southern Anatolia, which are probably made of native silver (Carter *et al.* 2003, 125, fig. 14; Campbell 2011, 22), it is only in the 4th millennium that silver begins to appear regularly. In northern Mesopotamia, at sites like Hacinebi, Brak and Hamoukar, silver artefacts appear in the form of ornaments (such as earrings, beads and pieces of silver wire) early in the millennium (Özbal *et al.* 1999, 60, 64; Emberling and McDonald 2002, 949, fig. 3; Reichel 2007–08, 80, fig. 8; Helwing 2014, 415, fig. 3a). A few silver artefacts, mainly ornaments, also occur at Uruk in the south in the earlier part of the 4th millennium (Helwing 2014, 415, fig. 3a), and

later in the millennium we also find silver animal figurines (some of them also cast by a lost wax process: see e.g. Hamilton 1967) and a few fragments of silver vessels or vessel attachments, some of them badly corroded, in the early Eanna temple (Heinrich 1936, 41, 47, pls 6, 17a–b, 30c, 35; cf. Moorey 1999, 235).

Silver is already found in the first written proto-cuneiform records from Uruk IV around 3300 BC, and Uruk III around 3100 BC, where it is denoted by the Sumerian sign *kug* or *ku*, whose semantic field seems to have the sense not only of metal but also of precious, pure or noble (Green and Nissen 1987, 233 no. 301; Falkenstein 1936, 55; Joannes 2010, 487; Guichard and Marti 2013, 50–51, 62). There are some indications that it may have been offered to the goddess Inana already in this early period; and it certainly was offered to her as ‘morning Inana’ (*i.e.* Inana associated with the sunrise) during the 3rd millennium (Szarzyńska 1993, 16–21 with table 2, fig. 4; Meador 2000, 13; Evans 2012, 98). The notion of ‘pure’ is perhaps especially interesting – not only maybe in relation to gifts to deities, but also possibly in relation to the fact that Mesopotamian silver was probably mainly obtained through cupellation of argentiferous lead ores. Litharge – the residue left after the extraction of silver from silver-rich lead minerals by cupellation – has been found at various places on the Iranian plateau in the earlier part of the 4th millennium (corresponding to the early Uruk period), including Tepe Hissar, Sialk and Arisman, and also at Fatmalı in eastern Turkey (Hess *et al.* 1998; Helwing 2011; 2014, 415, figs 2–3a; Nezafati and Pernicka 2012); and in the later Uruk period (at around 3300 BC) in the Uruk colony and trading post at Habuba Kabeira on the Euphrates bend, where a suite of lead objects was accompanied by a number of litharge cakes, which clearly came from the bottoms of cupellation hearths (Pernicka *et al.* 1998; Helwing 2014, 415, fig. 3b). There thus seems absolutely no doubt that, by at least the middle of the 4th millennium, Uruk period cities (including the city of Susa in what is now southwest Iran) were making use of cupellated silver, with the silver itself coming either from Anatolia, where silver sources could be found in the Pontic mountains, in the Taurus or in the Ergani region of the Upper Euphrates, or from the Iranian plateau, or from all of these (Lehner and Yener 2014, 531–32, fig. 20.1). By the Jemdet Nasr and Early Dynastic 1 periods from around 3100 BC into the early 3rd millennium, impressive quantities of lead vessels are found at southern Mesopotamian sites (Potts 1997, 176; Moorey 1999, 235, 294), an index, it could be suggested, not only of the scale of cupellation but also probably of the numbers of more precious silver vessels which, unlike the lead ones, were not abandoned to the ground in the urban southern Mesopotamian environment, where few graves are known.⁶

I want to come on now to the question of why southern Mesopotamia adopted silver in particular as an elite

metal of choice during the 4th millennium, and in the 3rd millennium went on to elevate it into a standard of exchange equivalence and a medium of payment, especially for transactions of greater value. One reason, as I have suggested, is silver’s novel status in the 4th millennium, but it also seems to me that just as important is probably the balance between relative rarity and relative availability. Southern Mesopotamia has no metal resources of its own, and this of course includes silver. However, as we have already seen, silver *was* available on the Iranian plateau to the east, through which another highly desirable material, lapis lazuli from Badakhshan, had begun arriving in the Early Uruk period in the early 4th millennium (Potts 1994, 213–14). Silver was also available in various parts of Anatolia, some of them a considerable distance from southern Mesopotamia (see above); and, as will be discussed further below, it was also available around the distant Caucasus. In other words, unlike gold, it was available in considerable quantities in surrounding regions, but it was not *too* available, meaning that it remained exotic, involved considerable effort and expense to acquire, and that not everyone could get hold of it easily – a factor which probably contributed to its desirability in the eyes of gods, kings and other important or powerful individuals. This is likely to be reflected, for example, in Sargon of Akkad’s boast of having conquered the ‘upper region’ around 2300 BC, in which lay the famous and romantically named ‘silver mountain’, variously identified with Bolkardağ in the Taurus or the Keban region of the upper Euphrates, both hundreds of kilometres away from Akkad (Hirsch 1963, 3 Sargon b2, 38 ll. 22–28; Joannes 1987, 487; Moorey 1999, 234–35). As to why silver became a Mesopotamian standard of exchange equivalences, and indeed a form of currency, from around the middle of the 3rd millennium (Marfoe 1987, 34; Powell 1996; Moorey 1999, 237; Peyronel 2010, 927; Helwing 2014, 418), the answer probably lies in just this balance between relative availability and relative exoticness, in addition to the ability of silver to be stored indefinitely and its inability to be used for anything obviously practical. In respect of this fine balance between availability and rarity, Mesopotamia, where in the late 3rd millennium silver was typically one-tenth of the value of gold (Garfinkle 2008, 63, 67), can be contrasted with Egypt, which had no easy access to silver but good access to gold from Nubia, and where silver was usually roughly twice the value of gold during much of the New Kingdom, but where at various times gold, rather than silver, formed the main standard of exchange (Moreno García 2016, 21; Muhs 2016, 75–76). Another factor that may have promoted the use of silver as a currency in 3rd millennium Mesopotamia is the existence of separate city-states which needed some common means of carrying out transactions both within and outside their individual territories, and particularly the role of private merchants in working with the palaces and temples to

acquire and distribute commodities both locally and over long distances (Van de Mieroop 2014, 26).

The Caucasus and the wider Near East

I would like at this point to broaden attention to two quite separate regions: one in the north, where silver objects already occur on either side of the Caucasus in the earlier part of the 4th millennium (Rezepkin 2010; Ivanova 2013, 90; Helwing 2014, 415, fig. 3a; Courcier 2014, 615–26); and the other in the Levant, where silver is found in the later part of the millennium, at the same time as it first turns up in Egypt (Prag 1978; Philip and Rehren 1996; Philip 2002, 219). It has been pointed out for many years that there appear to be links between Mesopotamia and the Caucasus, in the form for instance of the engraved imagery on a couple of silver vessels from the so-called ‘Royal Tomb’ at Maikop, north of the Caucasus, first excavated in the 1890s (e.g. Rostovzef 1920, 15–17, fig. 20, pl. iv:1–2; Chernykh 1992, 72–73; cf. Sherratt 1997, 461–64, fig. 18.3).⁷ Such links are also apparent in Transcaucasia, south of the Caucasus (Courcier 2014, 617; 2010, 88; Bobokhyan *et al.* 2014, 284, 293–94). The Maikop and other north Caucasian tombs contain a wealth of silver and other metal vessels from around 3800 BC (Chernykh 1992, 67–72; Courcier 2010, 79, fig. 3; 2014, 615–18; Hansen 2014), presumably because it served local social or political aspirations well to make lavish statements by depositing them in tombs (cf. Wilkinson 2014, 195). What are perhaps less well known, however, are the similarities between some of the North Caucasian ceramics and Middle Uruk ceramics (for example, from Tell Sheikh Hassan, a Middle Uruk colony on the Euphrates bend and from Tell Rubeideh on the Tigris, dating to around the middle of the 4th millennium) (Rezepkin 2010, 95–97, figs 1–4). These have the effect of making the two regions seem even more firmly linked and perhaps in certain respects, as I shall suggest below, culturally entwined. In particular, it seems worth calling special attention to the spouted vessel and ladle from the Klady kurgan near Novosvobodnaya⁸ (illustrated in Rezepkin 2010, fig. 4:4,7), which, like their Mesopotamian counterparts (Rezepkin 2010, fig. 4:1–3,5–6 from Tell Rubeideh), were clearly used for the serving and consumption of liquids.

How much Mesopotamian silver metallurgy might have owed to Caucasian metallurgy in the 4th millennium is an interesting question. There is currently a certain amount of debate as to which way influences went in general, and Mariya Ivanova (2012; 2013, 108–29) has recently argued that the North Caucasian links, including the style of the decorated silver vessels from Maikop and the wheel-made ceramics, actually relate more to the Iranian plateau and southern Central Asia to the southeast than to Mesopotamia to the south. I, for one, do not see this as necessarily a problem. In the mid-4th millennium there was an increasing

communality of material cultural features which linked Mesopotamia with Iran and south-eastern Anatolia, which can be symbolised by the distribution of mass-produced bevelled rim bowls (see e.g. Roaf 1990, 64–65; cf. Goulder 2010, table 1), which possibly represent the spread of leavened bread-making from the Uruk urban centres (Goulder 2010). This also extended to other similarities to suggest that networks traversed this entire area throughout much of the millennium (Sherratt 1997, 468, fig. 18.4; Wright 2001; 2013, 57–69; Rothman 2013; Petrie 2014), so that it is difficult to point to any one part of it as a source for links with the Caucasus region. In the case of Caucasian and Mesopotamian silver metallurgy, I do not see why it should not have been a two-way process. The Caucasus was clearly a precocious metal-working region, in which the production of vessels in different metals, including silver, and the use of the lost-wax technique of casting (Piotrovsky 2003, 292), was well advanced in the middle and later 4th millennium. On the other hand, the paucity (so far) of metal vessels in contemporary southern Mesopotamia need not mean that they did not exist there. They were possibly not putting them in graves, as they were in the Caucasus region (although in fact we do not have southern Mesopotamian graves in this period), but already it seems that they may have had better things to do with them.

At any rate, it seems likely that by the mid-4th millennium silver had already acquired, or was fast acquiring, considerable status and value in the urbanised social, cultural and resulting economic value system of Uruk Mesopotamia. And in these circumstances, the further one is willing to go outside this value system to acquire silver, the lower the exchange costs. This is because those not entirely integrated into the cultural and economic value system have no reason to put the same premium on it, and are willing to exchange it with those within the system for less in terms of the system’s internal exchange value. The Maikop and general north Caucasian habit of piling silver and other metals into graves suggests that, although silver may have had high social and cultural value in a local context, it had not yet acquired the same kind of economic value as it was rapidly acquiring in southern Mesopotamia, or, rather, that, unlike in southern Mesopotamia, it was not used there at this time as a medium for the accumulation and storage of wealth. In southern Mesopotamia this at least partly resulted from its relative rarity and the effort involved in its acquisition, for which other (particularly manufactured) goods had to be provided in return;⁹ while in the Caucasus region, close to a number of nearby sources of silver, silver was presumably not seen as either rare or difficult to get hold of. This sort of difference in values is beautifully summed up by Diodorus Siculus in the 1st century BC, who, speaking of the first Phoenicians in Spain (whom we now know reached there by around 900 BC), tells us that ‘since the natives there were ignorant of the real value of silver, the Phoenicians,

experts in commerce, were able to acquire silver from them in exchange for other goods of little value' (Diodorus Siculus 5.35). If, as has been suggested (Sherratt 1997, 466), the otherwise unexplained links between Mesopotamia and the Caucasus were due to a search for metals (particularly silver) in the latter region, then it is an early example of a process that we can see repeating itself over the millennia, in the case of early 2nd millennium Old Assyrian merchants setting up an extensive trade network centred on Kültepe-Kanesh in central Anatolia to pull in silver from western Anatolia and the Aegean and transport it back to Assur in exchange for tin and fancy textiles (Veenhof 1997; Barjamovic 2008); in the case of Phoenicians going as far as Spain in the early 9th century BC to acquire silver (when there were sources much closer to home) (González de Canales, Serrano and Llompert 2006); and also in that of the Spanish going all the way to the New World in the 16th century AD for the same purposes.¹⁰

Silver and wine: the Levant and the Caucasus

I would like now to move southwards to the Levant in the later 4th millennium, in order to introduce another desirable aspect of silver. At the sites of Tell-esh-Shunah in the northern Jordan valley and Tell el Far'ah near Gaza we have the remains of sheet silver drinking vessels, in the former case in association with grape pips (Philip and Rehren 1996; McGovern 2003, 213). What is particularly interesting is that analysis of the Tell-esh-Shuna silver fragments suggests that they were made of recycled silver, suggesting that there was already much more silver around than was left in the ground. These silver vessels can be dated at roughly around the same time as a new grey burnished ware, with a limited range of forms, including drinking vessels, appears in Palestine and Trans-jordan. Philip and Rehren (1996, 144–47) have suggested that this grey burnished ware, which is mainly found in graves, echoes silver vessels (in which case we should probably want to think in this region at this time in terms of greyish, unpolished silver), and that it, too, is an indication that silver vessels were already more common in the southern Levantine visual environment than the archaeological record, taken at face value, would lead us to believe. More importantly, however, both silver vessels and their ceramic counterparts may have direct or indirect connections with elite wine drinking rituals. Silver was and is an ideal metal to drink wine out of. Unlike copper, it does not react with the tannins in wine to leave a metallic taste (Sherratt 1995, 20, 40, n. 58), which is why silver (and gold) communion and kiddush cups are still associated with wine-drinking in many religious, symbolic or ceremonial contexts today. What could have greater cachet in the 4th millennium Levant than to be wealthy or important enough to be able to drink wine in formal, ceremonial fashion out of a silver cup?

While some of our earliest circumstantial evidence for this subsequently very long-lived association between silver and wine drinking occurs here in the southern Levant, it is perhaps worth pointing out that so far our earliest organic residue evidence for grape wine, in the form of tartaric acid, comes from the site of Hajji Firuz Tepe in the northern Zagros in northwest Iran, and dates to the later 6th millennium (McGovern 2003, 64–68). Wine residues have also been found in large jars at Godin Tepe, further south in the Zagros, dating to the later 4th millennium (McGovern 2003, 43–55). The whole area of northwest Iran and eastern Anatolia, including the Caucasus, falls within the modern distribution of wild grapes (see McGovern 2003, 2, map 2), and it seems very probable that, if they were drinking wine at Hajji Firuz in the later 6th millennium they were also drinking it over a much wider area stretching northward right up and over the Caucasus. Indeed, a number of ceramic jars from late 6th–early 5th millennium sites in Georgia have decoration which has been interpreted as showing people dancing under what look like bunches of grapes, while further residue traces of wine have also been claimed from the early 6th millennium Georgian site of Shulaveri (McGovern 2003, 75–76, fig. 4.2). Was it therefore in or around the Caucasus, part of a wine-producing area from very early on, with plentiful access to silver and with some highly developed metallurgy in the 4th millennium, that the happy and lasting conjunction of wine and silver was first appreciated?

Silver as currency, silver as bullion and silver hoards

During the 3rd millennium, when we have clear textual evidence for silver as a regular standard of exchange equivalence in greater Mesopotamia from at least Early Dynastic IIIa around the middle of the millennium, it is used increasingly as bullion as a means of accumulating and storing wealth, or as currency in circulating and transacting, including paying tribute, as texts from Ebla in north-west Syria around 2300 BC make clear (Archi 1988; 1996; Michalowski 2003, 461–62). Yearly palace accounts of silver and gold were headed by a record of the spending of 1 mina of silver for the silver head of the god Kura, and with the records of gold described in terms of their equivalents in weights of silver. The total amount of silver expended according to one text (75.2429: Archi 1996, 91; *cf.* Michalowski 2003, 461–62, no. 324a) comes to 369 minas (or around 173 kg), with 1109 minas (521 kg) remaining. On another tablet (75.1271; Archi 1988, 47–49; Michalowski 2003, 461–62, no. 324b) is a record of silver (34 minas and 37 shekels) paid in tribute by the palace at Ebla to the King of Mari.

Perhaps not surprisingly, from around this time on, most of the silverwork found archaeologically (and thus

deliberately deposited) in the Mesopotamian heartland consists of personal ornaments (Moorey 1999, 236), and it is only really around the edges of this region that a wider variety of silver objects is found in deliberate contexts of deposition, including vessels (for example in Anatolia and the Aegean), with the weights of these vessels probably originally based on standard weights of silver (*e.g.* Sherratt 2000, 37; *cf.* Peyronel 2010, 926–27; Bobokhyan 2010, 192–96; Rahmstorf 2015, 164–66). Silver ingots (or parts of ingots) and ingot moulds are found in hoards over a wide arc of Anatolia, northern Syria and northern Mesopotamia at the time (Peyronel 2010, with fig. 1; Antonova *et al.* 1996; Bachhuber 2015, 171–77), largely coinciding with the geographical reach of Vasif Şahoğlu's 'Anatolian trade network' in the later 3rd millennium (Şahoğlu 2005),¹¹ and also to a large extent with David Wengrow's 'sacrificial economy' zones (Wengrow 2011; *cf.* Wilkinson 2014, 194–98, figs 5.34, 5.35). Balance weights are found at much the same time over a similar wide area (Rahmstorf 2006, 67–79, fig. 11).

Summary remarks

Going back to the beginning in the 4th millennium, the appeal of silver, particularly as far as the newly emergent urban centres of Mesopotamia were concerned, depended, it seems to me, on several things:

1. Its uselessness for any strictly practical purposes (as nicely brought home in the 3rd millennium 'Dispute between silver and copper'). This presents a strong contrast with copper, which by the end of the 5th millennium was beginning to be seen as a metal above all for utilitarian objects, like tools and weapons, which had the effect of undermining its earlier value as a metal primarily for ornament and display and exchange. In other words copper was now for *functional use*, rather than accumulating as a form of social (or indeed sexual) capital, or wealth.
2. Silver's shiny appearance. In this of course silver did not differ much from other metals (particularly copper and gold) already in use, but what it did do was offer the possibility of colour contrasts (as seen for instance in the swords from Arslantepe, or in the silver inlays added to other copper objects). In this respect it fits into a context in which more complex ores and different alloys were being experimented with (as in the Nahal Mishmar hoard) in order to jazz up copper objects by giving them a variety of different colours.
3. In the case of the southern Mesopotamian urban centres, its relative rarity in a region which had no metal resources of its own. However, this was only relative, and it was acquirable from adjacent regions (particularly the Iranian

plateau, various places in Anatolia and possibly up as far as the Caucasus). The fact that silver was accessible (but not too accessible), probably mainly in exchange for manufactured goods like fancy textiles and the urban technologies involved in making yeast-based products like beer and leavened bread, or mass-produced wheelmade pottery, struck a crucial balance in this respect. It was exotic, and therefore desirable, but nevertheless possible to get hold of for those with the means to organise this.

4. Its late appearance in the sequence of take up of different metals, which meant that when it did appear in the 4th millennium it had the cachet of novelty.
5. Finally, the classic conjunction of silver and ritualised wine drinking – a conjunction possibly first discovered in northeast Anatolia, the Caucasus or northwest Iran, which had plenty of both silver and wine, but which perhaps first becomes archaeologically visible in the southern Levant, where silver had originally to be imported probably from much further north. This was a conjunction which still persists to this day, particularly in certain religious rituals.¹² That silver and wine together, curiously enough and in yet a different way, can still arouse the passions of hard-headed investors in the globalised financial world of today for several of the same reasons as silver appealed to the movers and shakers of early Mesopotamia is shown by the enthusiastic recommending of both, along with art and gold, as transportable and easy to store physical assets, which attract no income tax, and whose performance is unrelated to the more unpredictable performance of equity markets. Arguably just like silver in 4th millennium Western Asia, these appeal because of their scarcity, desirability, durability and stability (Roseman 2011; *cf.* Peyronel 2010, 927). In other words, they in general, and silver in particular, appears to excite just as much desire now as silver did almost 6000 years ago.

Notes

- 1 'Weapons', like the silver dagger from Nalchik in the north Caucasus of around 3000 BC (Hansen 2014, 395, fig. 9), should probably be seen more as personal ornaments or items of display than as strictly functional objects.
- 2 It also fulfils several of A. Appadurai's five characteristics of luxuries (Appadurai 1988, 38).
- 3 One of the names of the moon god, Nanna, was Ašimbabbar (Black *et al.* 2004, 126).
- 4 Several of the Nahal Mishmar objects were also produced by lost-wax casting (Moorey 1988, 174).
- 5 Heavy shaft-hole tools particularly in south-east Europe (see *e.g.* Zachos 2007, 175–76, 179–80; Renfrew 1970), but other shaft-hole objects, especially maceheads, seem also to have been current in Anatolia (Moorey 1999, 255).
- 6 Before the end of the millennium, in the so-called 'Final Neolithic', silver ornaments also appear in the Alepotrypa

cave in southern Greece (Zachos 2007, 172, fig. 11.2: b–g; Maran 2000). It is assumed that this silver was also derived by means of cupellation, on the grounds that litharge has been found in Final Neolithic contexts in Attica and on Thasos (Rahmstorf 2015, 164, fig. 12; Nerantzis and Papadopoulos 2013, 185–86). If so, in view of the developments which had already taken place in the Near East earlier in the millennium, it would seem curious that the Aegean should have thought of obtaining silver by cupellation quite independently at this time, as Rahmstorf (2015, 164) points out.

- 7 The Maikop ‘royal tomb’ and comparable kurgan burials in the Kuban region of the North Caucasus were, until relatively recently, traditionally dated to the later 3rd millennium (e.g. Rostovtzev 1920, 15; Piggott 1968, 81–82; cf. Sherratt 1997, 461). However, it is now clear, on various grounds, including C¹⁴ dates from contemporary cultures and comparisons between the ceramics and those of sites such as Tell Rubeideh in northern Mesopotamia, that they belong no later than the middle centuries of the 4th millennium, starting around 3800 BC (Shishlina *et al.* 2003, 331; Sherratt 1997, fig. 18.2; Rezepkin 2010; Ivanova 2013, 54; Courcier 2014, 601–04). The links should thus be with the Middle to Late Uruk periods rather than the 3rd millennium. For a concise history of the chronological interpretation of Maikop, see Izbitser (2003, 289–90; Ivanova 2013, 53–55).
- 8 For the contemporary or overlapping nature of Maikop and Novosvobodnaya, whether or not one wants to divide them into two separate ‘cultures’, see Shishlina *et al.* (2003); Sherratt (1997, fig. 18.2).
- 9 See Shishlina *et al.* (2003) for the possibility of Mesopotamian or Mesopotamian-influenced cotton and woollen textiles at Novosvobodnaya sites.
- 10 Possible objections to the idea that southern Mesopotamia was acquiring silver, either directly or indirectly, from the Caucasus may lie in the argument (Ivanova 2013, 90 citing Galibin 1991 [*non vidi*]) that most examples of north Caucasian silver objects analysed (to date solely from the Klady cemetery) contain little or no lead, which speaks against the large-scale exploitation by cupellation of argentiferous lead ores in the Caucasus, as (she argues) does the absence of lead objects (though see Chernykh 1992, 73) and of deposits of litharge from sites in the North Caucasus and Transcaucasia. Helwing (2014, 415 n.14) also suggests that the Maikop silver objects were probably made of native silver. On the other hand, argentiferous lead ores certainly exist in the Caucasus (Courcier 2014, 622; Hauptmann *et al.* 2010, fig. 1); and see also Courcier (2014, tables 22.7 and 22.10) for silver beads and rings from the earlier part of the 4th millennium in Transcaucasia, some at least of which have a lead content that might suggest the silver was derived from argentiferous galena (cf. Moorey 1999, 233). Hansen (2014, 398), acknowledging the very limited number of analyses so far undertaken on early silver objects, suggests that there is no reason to suppose that the cupellation process was not widespread in the Near East in general in the 4th millennium.
- 11 For the wide circulation of metals and metal objects (including those of silver) in the late 3rd and early 2nd millennia in the Near East and western Central Asia, see Wilkinson (2014, 168–76).

- 12 230 years ago this conjunction of wine and silver could also still be expressed in a context of romantic longing, in Robert Burns’ love song to Mary Morrison:

‘Gae fetch tae me a pint o’ wine and fill it in a siller tassie,
That I may drink, afore I gae, a service tae my bonnie lassie...’
(R. Burns, *My Bonnie Mary*, 1789: Quiller-Couch (ed.) 1919, no. 496).

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Chapter 8

Gold, conspicuous consumption and prestige – a relationship in need of review. The case of Early and Middle Bronze Age Crete

Borja Legarra Herrero

Introduction

Gold is eternal, it shines forever. In its purest form, it is a rare material that does not decay, corrode or change visually over time. In the modern world, it sits high in a diverse series of value regimes, from the vaults of national banks, to the medals of international Olympic athletes. This privileged position also applies to its place in past societies. Archaeological and historical evidence shows that most human populations have bestowed great significance on this metal (Betz 1995; Hahn 2014).

But are modern conceptualisations and patterns of consumption of gold applicable to the past? Which of the modern modes of production, exchange and consumption of gold objects are relevant to study the past? The gold mines of Brazil, as famously photographed by Sebastião Salgado, represent a very different reality to gold-plated luxury cars parked in a leafy London suburb. The consumption of gold in the modern world while normally attached to ideas of prestige varies widely depending on cultural ideas and practices (Hahn 2014). Highly visible displays of gold may be successful ways for communicating wealth and social standing in certain parts of the world, but they could be considered vulgar and rejected in other cultural contexts. Moreover, the way we display, use and perceive gold within a society is largely situational and relational. In modern Western culture, gold features heavily in sculpture in Catholic churches in allusion to the perfection of divinity rather than reflecting economic wealth. An Olympic gold medal differs greatly from a Rolex gold watch, even when both rely on the value and rarity of gold to signify success and prestige and both are designed to be displayed. The two items communicate very different things about their owners and they establish very different relationships between those who display them and those who see them. The Olympic gold medal, as much as it epitomises personal achievement,

also represents the national pride of a country. Gold watches can be displayed in everyday contexts, Olympic medals tend to be displayed in much more limited situations.

Gold found in archaeological contexts also can reflect a variety of conceptions of prestige and identity (Betz 1995) displayed in a range of situations. Gold as a metal, a natural raw material, has no intrinsic meaning nor value; its significance is created within a specific cultural context through a long and continuous process that includes the procurement of the metal, its exchange (as a metal or as a finished item), its transformation into objects, and its consumption. Under this simple premise, this article aims to present the use of gold items in Crete as a case-study that demonstrates how a contextual bottom-up approach can help to understand in more detail the particular roles, meanings and uses of gold items in a society. The study will particularly explore the phenomenon of conspicuous consumption and its relation to ideas of prestige.

Cretan gold: Trade and production

We are still not sure how gold arrived on the island of Crete (Figure 8.1). The nearest sources of gold are found in the north Aegean (Vavelidis and Andreou 2008; Andreou and Vavelidis 2014) and Balkans (Kopcke 2016). The few analysis of gold items in the Aegean from Early Bronze Age Kolonna and Late Bronze Age Thera seem to point towards the use of alluvial gold (Pantazis *et al.* 2003; Reinholdt 2008) which is consistent with north Aegean sources. Gold is also present in the islands of Siphnos and Thasos, but it is unclear whether these were exploited before antiquity (Williams and Ogden 1994; Muhly 2015). It has been suggested that at the end of the 3rd millennium BC gold started arriving on the island from the east Mediterranean together with other imported material that is now identified

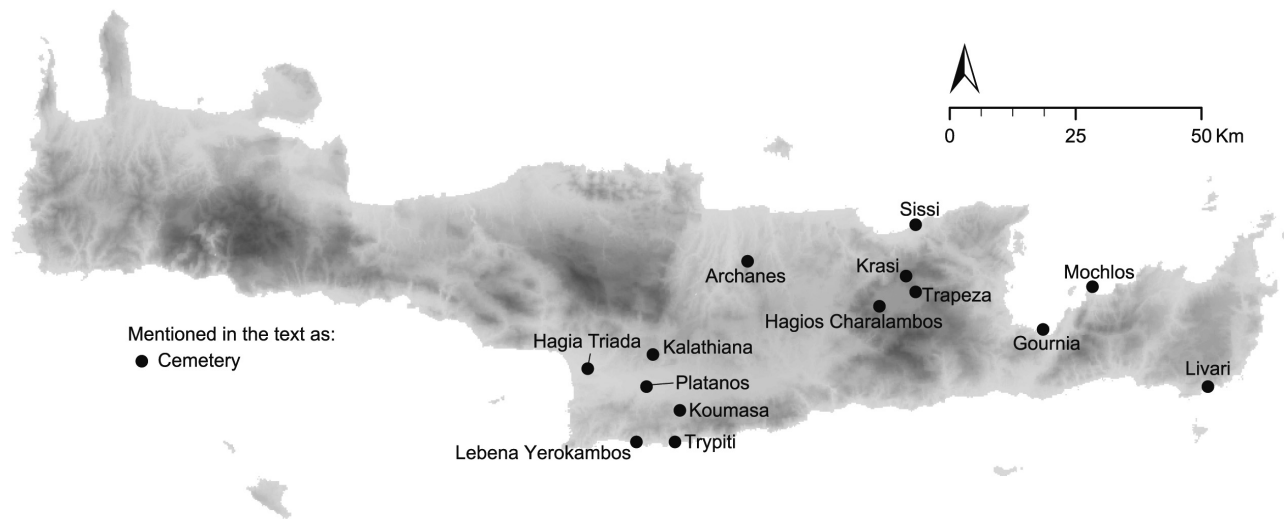


Figure 8.1 Cretan sites mentioned in the text

in the archaeological record (Legarra Herrero 2014b). Crete may have become part of the dynamic trade networks that moved Egyptian gold (Müller and Thiem 1999; Bultink 2015) and to lesser extent metal arriving through Syria (Pons Mellado 2006) across the east Mediterranean and beyond in complex multidirectional patterns (Heltzer 1977).

Neither is there a clear picture of the trade mechanisms that brought the gold to the island. Late Bronze Age Amarna letters demonstrate the existence of high-level diplomatic exchanges that included gold, but it is unclear whether this situation is relevant to earlier periods and it is unlikely that it would be the only type of exchange moving gold around the east Mediterranean. The possibility that gold circulated in gift-exchange networks is another mechanism discussed (Colburn 2008), although the nature of the gold items found on Crete has few parallels outside the island. Gift exchange networks are usually based on comparable types of items that relate to similar values and practices across the network (Mauss 1954) and it is difficult to identify shared types of items across the Aegean and east Mediterranean (but see Wengrow 2010). At the other end of the spectrum, gold could have reached the island in private trade mechanisms including down-the-line type of exchanges. The metal arriving through these convoluted mechanisms of trade, would have been decoupled from the ideological values it held in the east Mediterranean (see *e.g.* distance-parity models; Stein 1999). Another factor to consider are the agents that drove trade. More traditional views of east Mediterranean controlled exchanges are being now challenged with the possibility that Cretan communities actively pursued the procurement of gold. The amount of gold found at the cemetery of Mochlos, paired with the significance of boat iconography in the site may indicate that parts of community actively travelled in search of the items and materials they thought valuable (Soles 2012;

Legarra Herrero 2014a). The most probable situation is that gold arrived the island through a range of exchange types, all taking place at the same time and overlapping with each other. A varied range of ideological and economic rationales may have combined in the same exchange event. Despite the vague characterisation of the exchange mechanisms, it still should be borne in mind that the different forms in which gold was procured had an impact in the creation of its value and that exchange is a key factor in the differing ways gold was adopted and consumed by Cretan communities.

The possibility of Cretans being an active part of the exchange mechanisms fits well with what is known about the production of gold items on the island. Gold is relatively easy to work given its malleability, it can be simply hammered into shape, and the fact that many early gold items in the Aegean are flat simple pieces, such as the Neolithic 'ring idols' (Dimakopoulou 1998; Zachos 2007), shows how widespread these simple techniques were. During the 3rd and early 2nd millennia BC Cretan and Aegean items were decorated with quite simple techniques such as cold hammering, cutting and repoussé techniques (Branigan 2015; McCallum 2015), although these can combine to create quite distinct and elaborate items, such as the diadems and floral ornaments at Mochlos (Figure 8.2/ Colour Figure 8.2). It may seem slightly paradoxical that gold, a valued material, was worked in quite simple and easy to learn techniques that contrast with the complex skills and knowledge typical of silver and copper metallurgy (Vasilakis 1996; Legarra Herrero 2014b). This technical simplicity seems to have been somehow counterbalanced with the appearance of busy decoration programmes (the dog diadem at Mochlos, see Hickman 2011) and detailed, time-consuming decoration schemes that required time and skill (*e.g.* small chains and gilded beads at Platanos; Xanthoudides 1924).

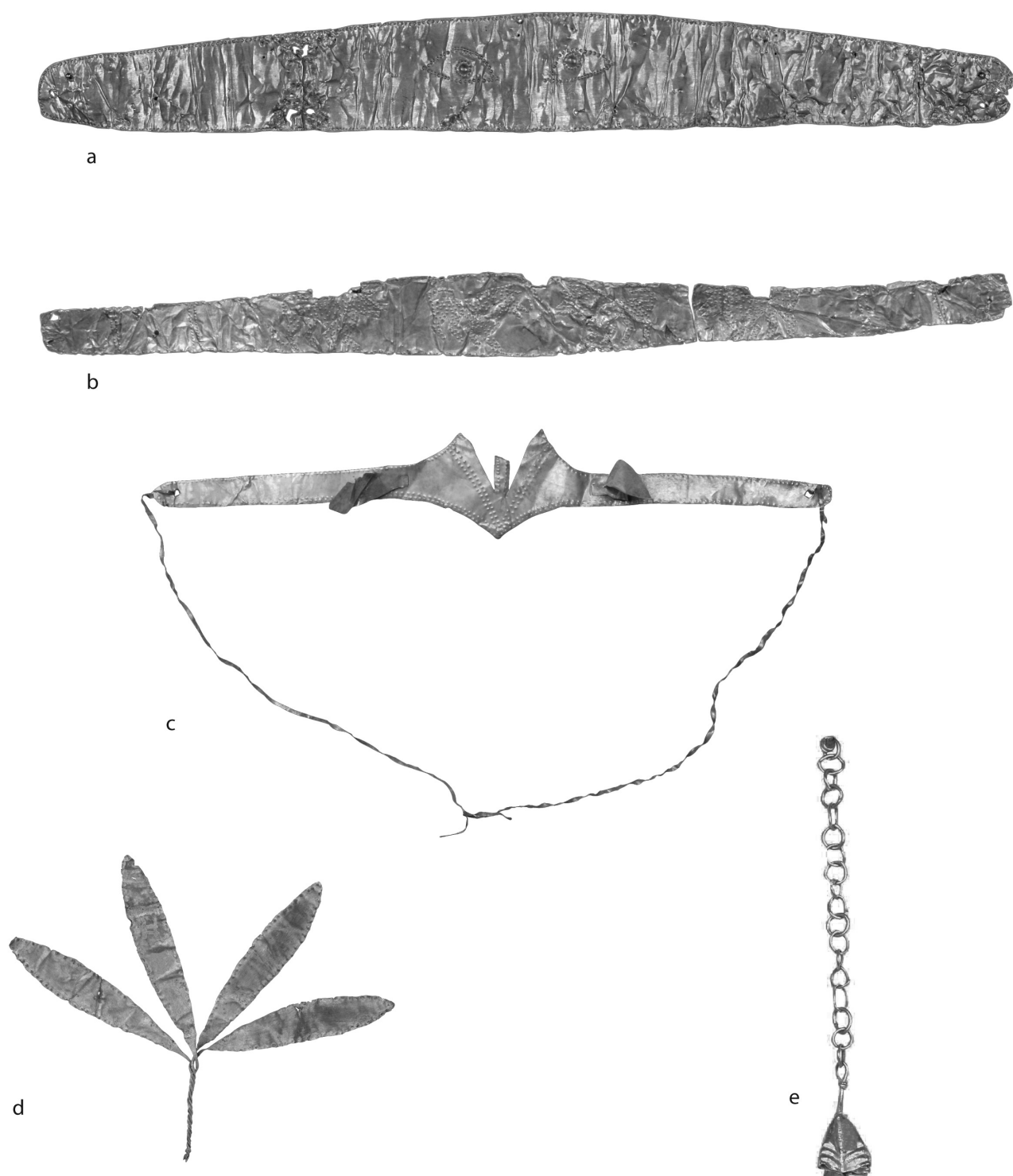


Figure 8.2 Diadem and floral ornaments from the Mochlos cemetery. (Archaeological Museum of Herakleion, Ministry of Culture and Sports – Archaeological Receipts Fund (YP. PO. A – T. A. P.))

It has been recently argued that more complex decoration techniques that require control of pyrotechnology such as filigree and granulation were in use in the Aegean earlier than originally thought. The earliest evidence of casting and filigree work can now be dated to the mid–late 3rd millennium (Reinholdt 2008; Hickman 2012). This early date could be supported by the evidence of Varna cemetery that shows casting of gold items in the 4th millennium BC (Leusch *et al.* 2015). The earliest items containing filigree and granulation on Crete come from disturbed deposits at Koumasa, Platanos and Kalathiana that can only be tentatively dated to the end of the 3rd millennium BC (Morero and Prévalet 2015). The appearance of these two techniques on Crete is significant in two ways. One, it continues the association of gold with intricate decoration and time consuming, highly skilled techniques that are unique to gold. Second, the detailed study of these new techniques has shown that early filigree and granulation techniques on Cretan items did not follow Levantine technical traditions and they were probably developed locally (Morero and Prévalet 2015).

The decorations applied to gold items (repoussé, filigree and granulation) appear extremely rarely in other metals, and there are very few parallels in silver to items created in gold (diadems, flowers, bosses). The manufacture and ornamentation of gold items could have been conducted independently from the other metals. This may not be due only to technological practicalities related to the properties of gold (malleability, softness), but to choices about the way value was attached to gold. To create culturally significant objects such as the distinctive beads at Platanos Tholos A or the diadems at Mochlos (Figure 8.2), the already particular raw material had to undergo an exclusive *chaîne opératoire*, perhaps involving a particular set of specialists or procedures.

The cultural significance of production has been already identified in the case of bronze. While copper and tin were imported to the island, there is evidence that bronze daggers, a central item in Cretan lifestyles, were made locally across Crete (Tselios 2008). In the case of gold, while it appears widespread in the record of the island, one cannot be entirely sure whether each Cretan community produced every item locally. Some items using repoussé and hammering techniques are easy to make locally but the knowledge and skill to apply filigree and granulation may have been restricted to the few communities in which these techniques are attested (Morero and Prévalet 2015). Were networks of exchange on Crete moving raw gold, finished objects, or both? Do we see similar patterns in consumption?

Gold and conspicuous consumption. A match made in heaven?

Before we look in detail into the Cretan production patterns and consumption choices, it would be useful to consider

a bit more carefully about the concept of conspicuous consumption as it has been repeatedly invoked in the interpretation of gold items in the Cretan archaeological record (Watrous 2005; Colburn 2008; Manning 2008).

When gold appears in the archaeological record, it normally (but not always) does so in exceptional contexts such as rich tomb assemblages, central large buildings and hoards. Egyptian culture provides the most influential of such cases for the study of gold in Crete (and probably elsewhere in the Mediterranean) as the textual evidence offers an intriguing insight into how gold moved around in Egyptian society and the ideological values that made it so prestigious (Aufrère 1991, 363–406; Müller and Thiem 1999; Pons Mellado 2006; Klemm and Klemm 2013; Bultink 2015). In the particular case of Egypt gold was sometimes referred as the flesh of gods and it is linked to divinity, an attribute that also applies to the Pharaoh (Bultink 2015, 21). Also, given its non-corroding qualities, gold was also attached to the all-important idea in Egypt of the afterlife (Müller and Thiem 1999). The pharaoh could also give gold as a reward to people that had distinguished themselves; gold necklaces would then be worn as a sign of prominence (Binder 2008) and deployed in a conspicuous manner. Were Cretan items used in a similarly ostentatious manner? Did they reflect a similar way of displaying prestige and status? Was gold's value built on similar meanings and ideas?

The term 'conspicuous consumption' was coined by Thorstein Veblen in his seminal work *The Theory of the Leisure Class* at the end of the 19th century (Veblen 1994 [1899]). Despite the term having found a place in our modern common language, it is not self-explanatory and requires a critical approach (Campbell 1995). Veblen gave the term a very specific meaning that fit the particular historical context of America at the turn of the 20th century and that he thought could not be readily be applied to other past societies, particularly prehistoric ones in which prestige was linked to warfare and religious activities instead to wealth (Veblen 1994 [1899], 2–5). While his depiction of prehistoric societies may seem nowadays simplistic, it goes to show that conspicuous consumption is a concept that was coined to fit behaviours typical of capitalist American society. Therefore, before using conspicuous consumption to understand the past, one needs to carefully assess and modify the concept, building on its critical review in other disciplines in the last decades (Campbell 1995; Trigg 2001; Patsiaouras and Fitchett 2012).

Conspicuous consumption is generally used to denote the pursuit of certain behaviours that allow an individual or groups to gain and maintain prestige and social standing (Veblen 1994 [1899], 24–25, 43, 64). While in the modern world this normally implies to display wealth, Veblen refers to it in relation to a more encompassing notion of prestige and social standing (Veblen 1994 [1899], 15–22).

Conspicuous consumption includes elements of behaviour such as the pursuit of certain activities (sports), ideals (ethic codes) and tastes (high art) that indicate a social difference based on cultural values. These exclusionary practices are communicated to an audience by a visible (ostentatious) display of certain items and behaviours. Nineteenth century American women may have worn elaborate costumes that are impractical to condescend menial labours (and therefore setting them apart from the working classes), that require high craftsmanship skills and relate to rather exclusive fashions (in a remarkably insightful and modern analysis Veblen saw this as the manipulation of women by men to mark their own social status while at the same time limiting their social roles and activities; Veblen 1994 [1899], 82–84). The aim is to display in a clear, visible (conspicuous) manner ideas of difference that are understandable to a wide audience.

This short description should already highlight the complexity of the situation. Conspicuous consumption intends to relay a message through certain actions and/or the use of certain items, and therefore subject to a whole series of factors that determine the effectiveness of this communication. Conspicuous consumption can only occur within a shared set of cultural ideas and meanings that make communication intelligible (Trigg 2001). Value regimes, ethical systems, religion, social structure, provide the meanings and moral ladders for conspicuous consumption displays to make sense. As any form of communication, conspicuous consumption is created through the active engagement of all parts involved, those who display it and their audiences (Chaudhuri and Majumdar 2006; Patsiaouras and Fitchett 2012).

Veblen was the first to acknowledge this complex process, as conspicuous consumption is only part of a much more elaborated model to understand the economic and social roots of certain excessive or wasteful behaviours. Conspicuous consumption is not an end in itself for Veblen, but it is a strategy to fulfil one of the principal desires that motivate most human actions, that of emulation (Veblen 1994 [1899], 17–19). Humans have an instinct to match normative behaviour, to try to emulate those who are seen as most successful based on the particular definition of success in each culture. Successful individuals are those who live close to the ideal norms of a culture. Prestige is defined as the recognition of this success and can be embodied and materialised through certain items such as a badge of honour. For late 19th century America Veblen considered that the idea of prestige was strongly attached to wealth, but for earlier societies he proposed that the ideals that defined prestige would be attached to war and violence (Campbell 1995). While Veblen's look at the past is now antiquated, he established that the principles that guide conspicuous consumption are variable and particular to each cultural context.

This has recently been explored in more detail through the concepts of social and cultural capital (Trigg 2001). The possession of specific knowledge (cultural capital) or the

power to influence people (social capital) should also be considered when defining prestige in relation to conspicuous consumption (Holt 1998). Restricted knowledge, signalled through certain items and behaviours, is in many ways more exclusive and difficult to achieve than wealth as it may require long periods of apprenticeship (e.g. the division of 'old money' vs. 'new money' nowadays relies heavily in education). The possession of restricted and/or esoteric knowledge could be signalled through particular items and behaviours (Trigg 2001). Conspicuous consumption can also be used to mark and obtain social capital. The display of certain badges of prestige indicate the trust that a group of people has bestowed on a particular person. At the same time, displaying a particular item may convince population to trust and follow the wearer as the item indicates that he or she has already certain influence over people or that is bound to certain standards that make him/her trustworthy.

The concept of conspicuous consumption therefore offers several challenges to the archaeologist. First, there is a need to take conspicuous consumption out of the cultural context in which Veblen conceived it and apply it to specific past social, ideological and material environments in order to make sense of it. Second, the concept requires a fluid framework that acknowledges the constant negotiation of messages and meanings by the communicator and audience. Conspicuous consumption while establishes an unequal dialogue, cannot be just understood as a top-down type of communication, in which those displaying the ostentatious behaviour or material can control it at will. The audience always has a voice and reacts in different ways to the act of conspicuous consumption. The relation between the parts of the communication is in constant rebalance. One of most powerful recent critiques of Veblen's work recognises that many of the items and behaviours that are used for conspicuous consumption were first general cultural phenomena that were high-jacked by the elite (Patsiaouras and Fitchett 2012). Badges of prestige can be constructed bottom-up, based on commonly accepted behaviours and ordinary items, providing the act of conspicuous consumption with a powerful foundation on which to construct prestige as it is widely understood and experienced. The opposite process is also possible. Elite behaviour can be matched and copied by larger parts of society making it lose much of its differentiating value, and obliging the elite to construct new ways of communicating their difference. This means that the construction of prestige never ends. Prestige cannot be merely displayed and forgotten, but needs to be repeated and renewed through new practices and items, constantly performed with considerable effort and resources involved. The active maintenance of the differences through consumption can be quickly become a burdensome task (Veblen 1994 [1899], 21–22).

For the archaeologist the relationship between the material evidence and the concept of conspicuous consumption

becomes more problematic than it is sometimes assumed. In an extreme case, gold items may not be related to conspicuous consumption as they may not be part of actions that are considered to communicate prestige or acquire any type of cultural or social capital. The display of gold items may have other uses (medicinal, ornamental, religious) that do not involve elements of ostentatious display. Let us assume for a moment, that these alternative roles are extremely rare, and that the use of gold in one way or another signals ostentatiously elements of differentiation. This signalling can only make sense in a nested set of contexts that range from culture-wide (*i.e.* ideological and ethical frameworks) to the particular situation and practices in which it is deployed (*i.e.* audiences). All of these levels are in constant flux and state of negotiation, with meanings being created, maintained, modified or erased following different social strategies of emulation, cooperation, differentiation and integration.

Gold consumption and the creation of prestige on prehistoric Crete

Gold on prehistoric Crete has been traditionally understood as a way for elites to mark social and economic differentiation (Branigan 1983; 1991) in a period of major socio-political changes on the island that ended with the consolidation of differentiated palatial societies. Gold would have the added benefit that it would link incipient Cretan elites with their east Mediterranean counterparts, reinforcing the special character of the local elites through emulation processes (Watrous 2005; Colburn 2011). Crete appears as a relatively passive receiver in the gold exchange networks of the east Mediterranean, a scenario that it has already been challenged above. Cretan societies are largely ignored as passive, just followers of the key agents that we normally refer to as ‘elite’. It is true that most, if not all, gold items found on Crete were ornaments to be worn (Figure 8.3). Highly visible diadems with protruding antennae are the most conspicuous of these items (Figure 8.2), but we encounter also pendants, beads and bosses to be sown onto garments, pins, earrings and rings. There is little evidence that gold was used for items not to be worn, only a couple of gold fragments have been putatively suggested to have adorned daggers (Branigan 1983, 15; Vasilakis 1996, 86), and these can be seen in many ways as an item displayed in relation to the body (Nakou 1995). This way of displaying gold suggests that the metal enhanced embodied qualities of the individual wearer. Can this consumption of gold be interpreted as the badge of merit of an elite that used it to construct a distinct status and emphasis its distance from the rest of society? Or is there a more complex relationship between display, gold consumption patterns and social identities and communication? For example, how our understanding of these relationships would change if these

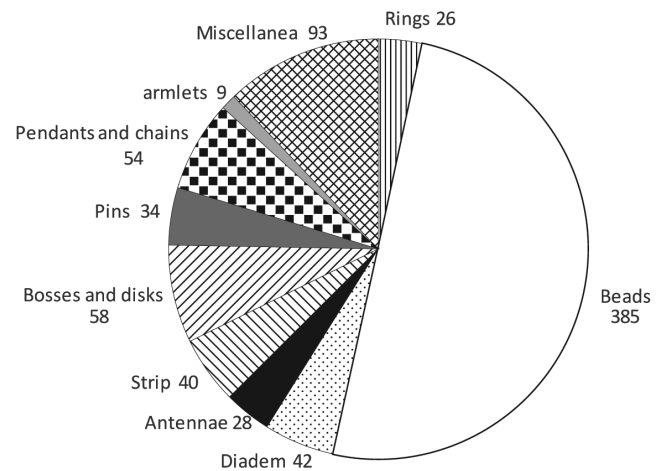


Figure 8.3 Breakdown of gold items found in Pre- and Protopalatial Crete by type

items were intended to be worn by females rather than the male agents that are normally assumed (*e.g.* chiefs)? How was prestige transferred in this case? How would the display of gold items by females connect to the acquisition of social capital?

Gold on Crete is not limited to a few sites, and together with the available contextual information, the picture presented is not simple. Gold from Prepalatial Crete comes from large communal tombs that housed a commingled deposition of bones and material in disarray with no clear direct associations amongst them (Legarra Herrero 2014a). The heavily disturbed burial depositions, while difficult to interpret in detail, seem to indicate that there was little regard about individual burials and no interest in maintaining human remains with associated grave goods (Legarra Herrero 2014a). Gold during life (and there is evidence objects were heavily used before deposition in tombs; Hickman 2011) and early parts of the funeral was mainly displayed close to the body, in elements to be worn, marking an intimate link between item and person. This close relationship did not transfer to the last phases of the funeral process. It has been argued that this pattern of disturbance in the collective tombs indicate a passage of the deceased to a new type of group identities (Driessen 2010; Girella and Todaro 2016). The evidence of secondary burial, manipulation of bones, use of fire, *etc.* (Triantaphyllou 2016), mark some of the ritual stages in which a deceased individual transformed its relationship with the larger community in which he or she belonged. Gold items meanings and use changed also as part of the processes of transformation that the deceased underwent, signalling a shift in the way prestige was communicated. While the burial community was aware of the presence of gold in the tombs, this was not anymore displayed; the consumption of these items was conspicuous no more. The contextual deposition of gold in Cretan collective tombs cannot therefore be directly compared

with tombs in the east Mediterranean where gold items tend to be clearly linked to individual burials (e.g. Byblos, see Montet 1929). A link between powerful individuals, the consumption of gold and the creation and maintenance of individual prestige and identities do not match the Cretan record. Before the rich-in-gold burial assemblages of the shaft graves of Mycenae at the beginning of the Late Bronze Age, there are not accumulations of gold in individual burials in the Aegean. Gold in Prepalatial mainland Greece comes from hoards, but these have no discernible funerary link (Legarra Herrero 2014b), as illustrated by the recently published Kolonna example (Reinholdt 2008). A bead that may come from a cemetery at Phyrrohes in the island of Naxos (Papathanasopoulou 1963) and a drawing pin and earring associated with one burial in Grave 9 at Sissi on Crete (Schoep *et al.* 2011) are the only examples known in the south Aegean before the mid-2nd millennium BC of gold items with a clear relation to a deceased individual. The two cases represent otherwise unremarkable tombs.

The display of prestige through the accumulation of gold may have occurred in parts of the burials that took place in Cretan tombs but then things took a different turn in the final stages of the funeral that have a profound impact the way this prestige was communicated and to whom was associated. It could be argued that the particular role of gold in Cretan tombs indicate that definition of prestige in the island was very different from Egypt and Byblos. The final deposition of gold in the collective burial chambers of Cretan cemeteries suggests that gold was a material that had meanings to the broad group that the tomb represented. Let us think for example of the case of the leader of a group. A display of gold (and the values to what this may refer to) may boost the prestige of the person who wore it and at the same time the group that supported him/her and provided the resources to endow that person with such valuable items. Another possibility would be that the gold items mark a religious position (female or male), identifying a woman or man whose role is to guide and mediate on behalf of the community that they represented. Needless to say, these examples are neither exclusive nor exhaustive, but they illustrate alternative interpretations of the role of gold items and remind us of an important point: despite being worn by a specific person, gold items link with the wider social group related to that person and that elements of the prestige that they mark reach social actors associated to the wearer.

It is clear that there are Cretan cemeteries and tombs in which there is a greater deposition of gold items, even accounting for problems in quantification (should we count individual beads? should gold be quantified by weight?). At the same time, the distribution of gold items shows they also are found in most of the well preserved communal tombs (Figure 8.4). This is particularly clear in the later phases of the 3rd millennium BC (Figure 8.5). This widespread distribution of gold items is difficult to

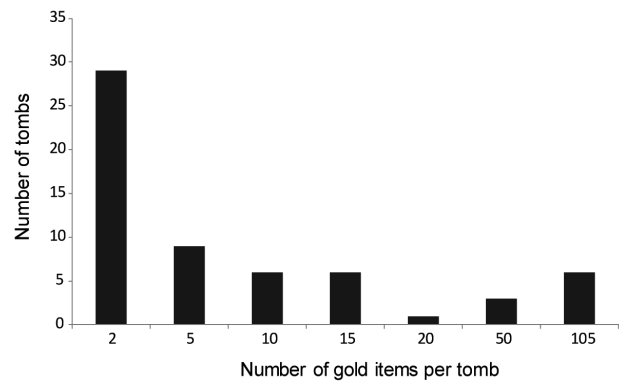


Figure 8.4 Gold items in Crete: histogram of number of items by tomb

explain as purely elite behaviour but fits with the collective nature of the tombs. Several of the tombs that include gold items are relatively modest in other grave goods and architecture features such as Livari (Papadatos 2015) and Trypiti (Vasilakis 1996), probably the interment places of small communities. Such small communities may well have had leaders and/or other representative social figures (elders, religious figures, military positions), but given the small social group (a small Cretan settlement may not have housed more than 20 people and possible larger kinship groups may not have been larger than a few hundred; Whitelaw 2001), leaders would be difficult to differentiate from the rest of the community (Driessen 2016). Most of the communities that deposited gold in their tombs did not have the demographic critical mass to support differentiated classes, and social negotiation may be resolved mainly in face-to-face exchanges (Feinman 2011). Leaders only wield a limited power in such small groups, much dependant in maintaining successful relationships with the rest of the community (Roscoe 2012). Gold in these communities was part of open social negotiations and power struggles rather than the symbol of a dominant elite with a strong control over the social group pursuing a self-centred socio-political agenda.

This interplay between demography, social relationships and political and ideological leadership must also inform the interpretation of the intra-cemetery distribution of gold items. A large tholos tomb such as Agia Triada A relates to a different social group and a different collective identity than a smaller rectangular tomb at the cemeteries in Archanes or Mochlos (Legarra Herrero 2009). The history of use of the tomb may help in cases to understand the concentrations of gold in certain tombs. The caves of Trapeza and Hagios Charalambos received a significant number of gold items (Figure 8.5), but the recent publication of the latter indicates that the archaeological deposit was formed during more than a millennium of interments, a long history of burial that came to a close with a major rearrangement of bones and grave goods around 1750 BC (Betancourt 2014).

Only in a few cases is there enough information to identify rich concentration of gold items in well dated stratified deposits (Figure 8.5) such as in Tholos A at Platanos (Xanthoudides 1924) and to a lesser degree in Tholos A at Agia Triada (Todaro 2004; Banti 1933) and in Lebena Yerokampos 2 (Alexiou and Warren 2004). Amongst these, the most discussed case in the literature has been the cemetery of Mochlos. With more than 20 tombs and more than 350 gold items (counting beads as separate objects), it is a site that has attracted much discussion about prestige, conspicuous consumption and social organisation on Crete (Soles 1988; Branigan 1991; Carter 2004; Watrous 2005; Colburn 2008; Legarra Herrero 2012; Karacic 2015). Most of the discussions have focused on the concentration of gold items in the two larger tombs of the cemetery I/II/III and IV/V/VI but gold items have been found in another ten tombs in the cemetery (Figure 8.6). In simple numbers, Tomb XXIII contained more than 130 beads, probably coming from one or two necklaces. A similar case may be represented by the several beads found in Tomb XXI.

Rooms II and V in the larger tombs not only housed a concentration of gold items, but these were larger and more complicated-to-fabricate items, such as heavily decorated diadems, some of them with antennae attached (Figure 8.2). This concentration has been interpreted as the indication of a rich group of individuals stating their distinct status from the rest of the community (Soles 1988; Branigan 1991; Colburn 2008). This view has been questioned recently as it has been argued that due to the relatively small community at Mochlos with a population in the low hundreds (see discussion in Legarra Herrero 2014, 104) and the distribution of gold items across several tombs, the cemetery may show an open competition between several groups (Legarra Herrero 2014a; Karacic 2015).

Looking more closely at the objects in the tombs, the assumption that the number of gold items can be mainly explained as how successful a group of elites were in achieving a distinct status may be reductionist. There is evidence to indicate that the deposition of items at Mochlos, and probably elsewhere, relates to a variety of cultural contexts and social structures, not only prestige. Most of the stylistic traits and iconography of the items in Rooms II and VI are found in the other Mochlos tombs (Figure 8.7) and tombs elsewhere in the island, indicating that the items express shared meanings and highlighting their ideological role. Similar beads, diadems (even when at Mochlos these are more common), and floral motifs are found in other cemeteries such as Platanos or Hagios Charalambos. Furthermore, there is evidence to support that richer tombs not only contained a distinctive burial assemblage but they also formed a focal point for the whole community to gather and practice together rituals (Legarra Herrero 2016). The burial of an individual accompanied by a rich gold assemblage in one of these central tombs

may have had several beneficiaries: the close relations of the deceased that may try to ‘inherit’ some of the prestige attached to the deceased; the broader group that used the tomb by marking their power at a local and regional level; and the community to which the buried belonged as they signal their prosperity to neighbouring communities in a period in which inter-settlement competition seems to have become more prevalent (Legarra Herrero 2016).

Conclusions

It has been suggested that the burying groups of Cretan cemeteries may be trying to mark prestigious figures through the deposition of gold items and that these positions may be comparable amongst most communities. Such figures should be understood as prestigious in the Veblen sense, they embodied the ideals and prescribed behaviours of Cretan societies. Such prestige had, however, a very different nature from the wealth-defined prestige typically attached to conspicuous consumption in the modern world. In the particular Cretan context, prestige as marked by gold items seems to have linked a combination of individual display and collective practice to a set of shared values that emphasised group identities. The use of gold in bodily adornments can still be described as conspicuous consumption in its most basic sense – it was to be ostentatiously displayed – but this embodiment may represent many more individuals than the single individual who wore the items. Gold was part of a complex interplay between individual and group prestige. I have tried to show that this type of consumption may not be interpreted in the same way as in 20th century American society and that conspicuous consumption aimed to achieve other goals that were not about personal prestige, marks of individual wealth and badges of exclusive distinction. It seems to have been used by Cretan communities to navigate their way in a new world of competing groups. The value of gold on Crete seems to rely on values that were open to any community. Prestige on Crete was also not only a way to differentiate, but at the same time it may have been used to bring groups together under certain shared displays of power and community pride. There were also utilitarian aspects to these conspicuous displays. Gold may have displayed cultural capital (restricted religious knowledge, technical skills like filigree, tastes and fashions of dress) in order to expand and cement social capital, to gain ascendancy over, and build alliance with more people.

Gold is almost by definition a conspicuously consumed metal. What this chapter has tried to show is that a ‘common sense’ approach based loosely on Veblen’s concepts is not sufficient to explain gold items in past societies. Prestige, status, religion, cultural values and conspicuous consumption are all complex concepts with multifaceted and variable relationships that can only be understood through a contextual and detailed look at the archaeological record. While gold may

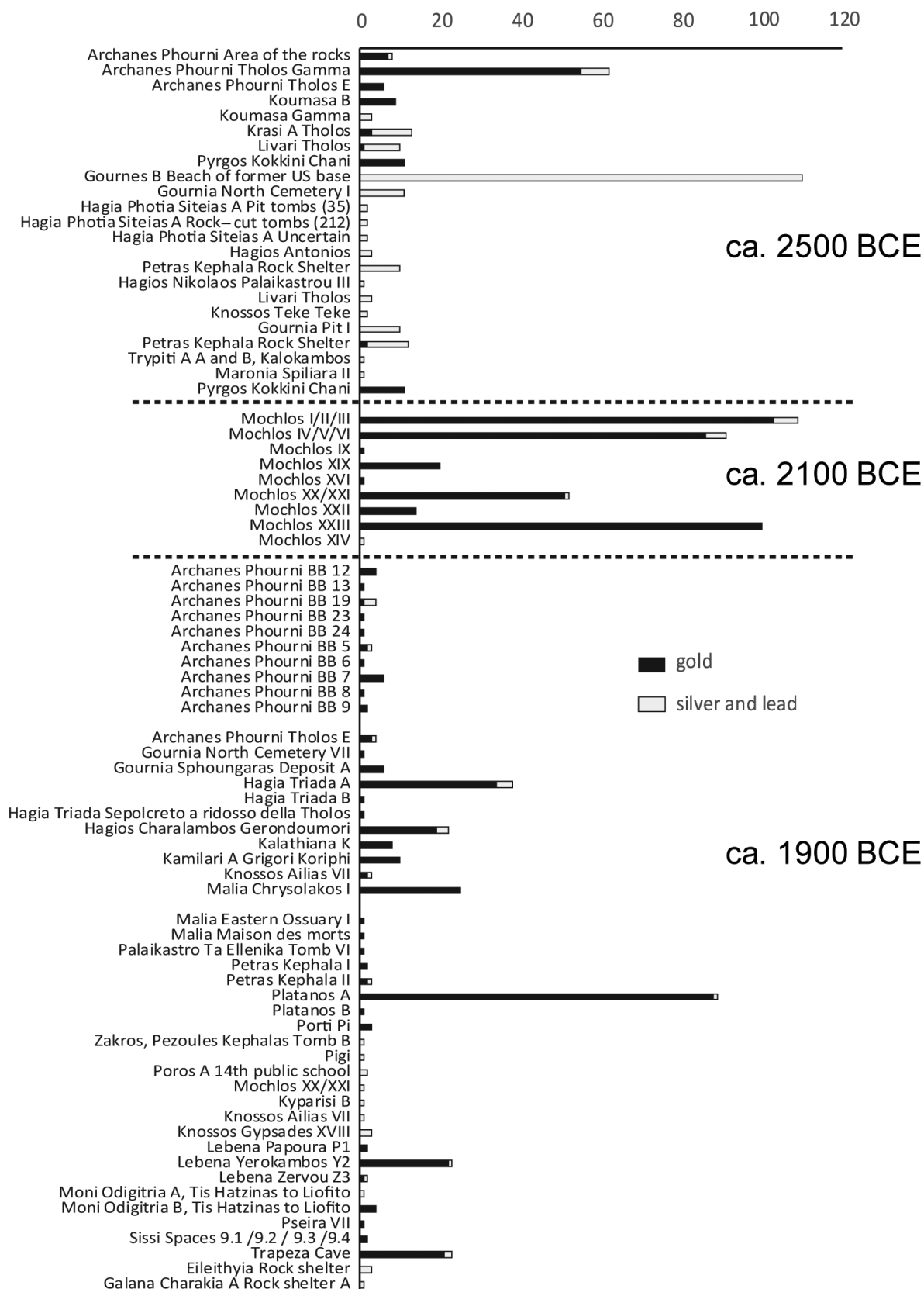


Figure 8.5 Gold items in Crete: number of items per tomb ordered chronologically

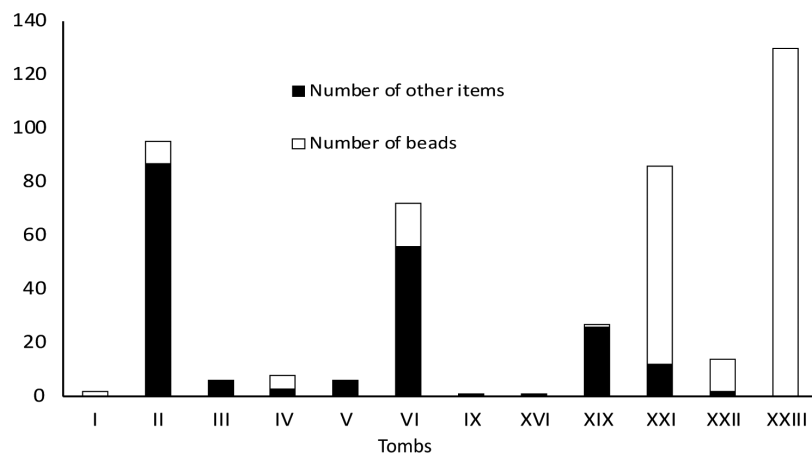
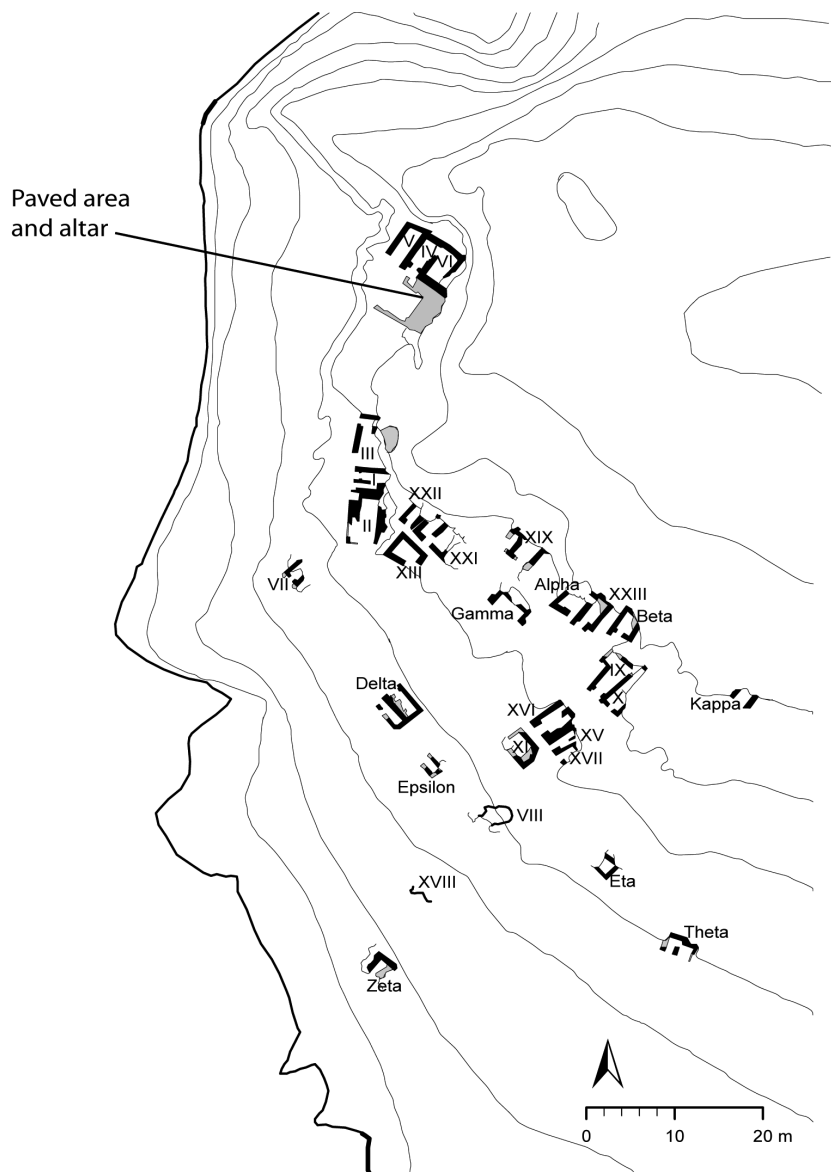


Figure 8.6 Mochlos cemetery plans and gold items per tomb

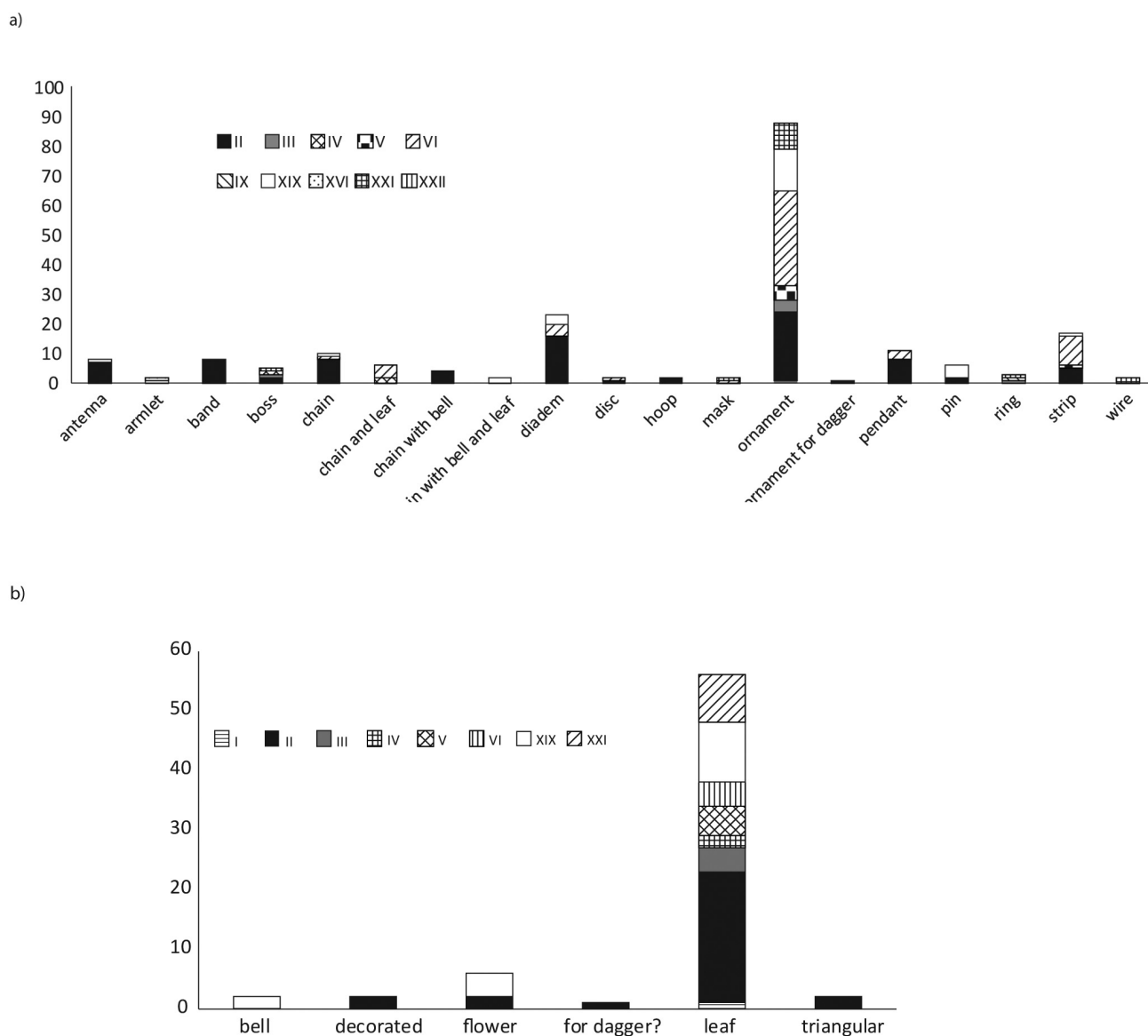


Figure 8.7 Breakdown of gold items per tomb by type and decoration

be a well-suited material to display value and prestige, the meaning of these two last concepts needs to be defined in each cultural context through a careful look at its archaeological details, production choices and consumption patterns.

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Part 3

Circulation of metal as commodities

Chapter 9

Biography, prosopography and the density of scientific data: Some arguments from the metallurgy of Early Bronze Age Britain and Ireland

Peter Bray

Introduction and outline

The literature on the integration of scientific methods and archaeology is large and wide ranging (Clarke 1968, 635; Hawkes 1968; Wilson 1973; Olin 1982; Thomas 1991; Dunnell 1993; Pollard 1995; Killick and Young 1997; Killick 2005; Pollard and Bray 2007; Martínón-Torres and Killick 2015). This current volume clearly demonstrates that there is an ongoing need to debate the relationships between theorists and lab based scientists. I, with Mark Pollard, have previously argued that we should approach this debate from the direction of pragmatics. Even with the best intentions, collaborative projects may be extremely challenging to fund and manage. It is not straightforward to define a common question and then develop a mutually intelligible language to discuss it in. It is certainly difficult to strike a balance between people capable of innovation within specific fields, and those who can translate across fields. However, we would argue that there are no insurmountable conceptual, cultural, intrinsic differences that prevent collaboration between any academic specialists. At the same time we must recognise that these collaborations are shaped and directed by the realities of archaeological practice (Pollard and Bray 2007).

This short paper aims to develop the theme of the pragmatics of collaboration by looking in detail at the scientific archaeometallurgy of Early Bronze Age Britain and Ireland and how it relates to the theory of material culture. What does the history of scientific analysis on this copper-alloy assemblage reveal about previous research teams' aims and motivations, and how can these data be used in current collaborations? In particular how does the nature of this archaeological record, and the scientific data derived from it, impact upon recent conceptual discussions of object biography?

Material culture theory and archaeological object 'life events'

While archaeometallurgists are happy (within our protocols, see Krause 2003; Pernicka 2014; Bray *et al.* 2015) to employ scientific data from the 1950s in fresh interpretations of past technologies, it is not straightforward to repurpose the contemporary archaeological theory. Christopher Hawkes writing in 1959 was happy to argue that iron's superiority over bronze allowed the invasion and colonisation of southern Britain by Hallstatt invaders (Hawkes 1959, 177). Though some of his specific conclusions may sound dated to modern ears, many important lessons can be drawn from Hawkes' broader aims and philosophy. He was central to the development of British prehistory studies and at the same time help found the first dedicated archaeological science research department in Britain (Research Laboratory for Archaeology and the History of Art, University of Oxford). It was Hawkes who coined the term archaeometry, and he serves as a prime example of fruitful dialogue across different specialisms. In many ways Hawkes was just as remarkable a polymath as his Oxford predecessor from 250 years before, Robert Plot (discussed below). These structural innovations were directly informed by his archaeological philosophy, where he argues (Hawkes 1954, 161),

You can, and of course must, conjoin your archaeology with natural history, in the analysis of raw materials, the investigation of techniques, and the study of environment and of your people's response to it, by every one of the natural sciences that can be brought to serve. All these things - and the study of modern folk-life too, if there is any relevant - are obligatory.

Hawkes' appeal to full interdisciplinarity, though unstructured, sounds very contemporary and will be

discussed further below. However over the last thirty years there has been a decisive break away from Hawkes' view of material culture, which includes the famous statement (Hawkes 1954, 162) that:

If material remains are easy to infer to, subsistence—economics fairly easy, communal organisation harder, and spiritual life hardest of all, you have a climax of four degrees of difficulty in reasoning. What is this climax? It is a climax leading up from the more generically animal in man to the more specifically human.

The separate degrees of reasoning, humanity, or purpose have become blurred within archaeological thought. The role of objects in actively negotiating and defining human lives and social processes has been increasingly recognised over the last fifty years (Gosden 2005; Joy 2009; Martínón-Torres and Killick 2015). This was often in direct response to the large volume of research operating within the framework that objects are passive, functional, or utilitarian (Gosden 2005). Conceptual strands such as materiality (Demarrais *et al.* 2004), agency of things (Dobres 2000), and Science, Technology and Society (STS, Geselowitz 1993) have been drawn together in the concept of artefact biography. This essentially states that we should animate the description of individual objects into life trajectories; both in terms of events such as creation, use, breakage or deposition, and also as a series of shifting relationships between the object, people, places and other objects. This is a popular and powerful idea, which can as a focal point for uniting a range of academic disciplines, including archaeological science. We could develop the obligation to apply all available investigative techniques together (Hawkes 1954, 161) to a structured framework for collaboration.

Several classic studies stand out in the traditional narrative of artefact biography studies. Particularly highly cited is Igor Kopytoff's (1986) paper on the cultural biography of things from the edited volume *The Social Life of Things* (Appadurai 1986). This book stands within a community of new approaches to the social sciences in the early 1980s which emphasised ongoing interactions of agents within structured times and spaces (Giddens 1984). How archaeological material objects interacted with other agents has become a diverse collaborative research area. One landmark was the Gosden and Marshall's (1999) edition of *World Archaeology* 'The Cultural Biography of Objects' which drew together archaeology, anthropology, social and material theory, and museum studies. Ten years later Joy (2009) explicitly tried to renew focus on the concept, though it is clear that he need not have worried—biography has begun to enter the standard toolkit of archaeological material culture studies, and has also been taken up by monument and landscape specialists (Lamberg-Karlovsky 1993; Skeates 1995; MacGregor 1999; Gilchrist 2000;

Fontijn 2002; Jones 2002; Mytum 2003; Meskell 2004; Crawford 2009; Hill 2012; Swift 2012; Blanco-González 2014; Kolen *et al.* 2015; Williams *et al.* 2015).

As often noted, there are a number of biographical resonances within traditional archaeological models (Joy 2009; Martínón-Torres and Killick 2015). Influential contributions include the concept of *châînes opératoires* incorporated from sociology (Leroi-Gourhan 1964) and Schiffer's (1975) work on behavioural chains within a wider description of natural and cultural formation processes. A schematic of the life cycle of archaeological metal from raw material, through processing, manufacture, use and deposition is a completely standard image in most textbooks. These models can loosely map to the literature on object biographies, though the links are often disjointed and perhaps expressed in language that many anthropologists would not recognise.

Alongside schematic process models, the practical techniques of scientifically studying metal artefacts can clearly provide 'biographical' information. Metallography can identify structures associated with the activity of the smith such as their use of heating, hammering, and quenching in the creation of an artefact (Scott 1991). Hardness values, especially when compared to lab-produced standard alloys, can also help describe the production process. Use-wear analysis on a range of materials and object classes has a long history and describes the active handling and application of artefacts (Wall 1987; Bridgford 1997). Careful examination of how artefacts were decorated can define different stages and themes within the life of an object (Moyler 2008). Structure within the chemical composition of copper-alloy objects, in particular deviation from the source signal, can be taken to show recycling of an older object into a new form, and characterise the wider flow of material (Bray and Pollard 2012; Bray *et al.* 2015). Lead isotopic ratios similarly illuminate life events through helping define source, use, and mixing (Rohl and Needham 1998). Typo-chronology and excavation place these events into time and landscape frameworks (Gerloff 1975; Needham 1996; Northover 2003). Despite metal being inorganic, radiocarbon dating can still provide absolute dates for material closely associated with copper artefacts (Needham *et al.* 1997; Sheridan 2007). These dates often relate to processes such as re-hafting, or burial practice. Overall, we have a palette of techniques available, each of which can provide nuggets of life events. Can further work explicitly build an integrated approach to copper-alloy biography, which is built upon the practical realities of archaeometallurgy?

Data density and material biographies

Many discussions of object biographies are directly influenced by the anthropological study of current material culture,

economies, and technology. The contemporary studies often have rich, ‘thick’, datasets and fine chronological resolutions. Kopytoff’s (1986) inspiration was drawn from the economic and social science literature, which represent an equally rich and broad base of data. Under these circumstances it is certainly feasible to trace intricate lives for individual objects such as masks (Seip 1999) or bags (Peers 1999). In the case of the western North American bag embroidered with the name ‘S Black’ in the collection of the Pitt Rivers Museum, Peers notes a series of shifting meanings that the bag created from initial manufacture in approximately 1840 through to the publication of the paper in 1999. As Peers’ (1999, 288) elegantly summarises:

Initially expressing affectionate ties between its maker and recipient, the bag later came to represent outsiders’ denigration of Native women and those who married them, and became an exotic souvenir in an English Victorian household. Still later, the bag became a museum artefact seen as expressing tribal identity, and most recently it is seen as embodying histories of contact.

A bewildering number of social shifts have occurred in a span too brief to be teased apart by most archaeological dating methods. Gell (1998) is even more intricate when detailing the changing balance of agency, identity and meaning within individual exchanges of material culture. His schematic plotting of the slashing of the Rokeby Venus by Mary Richardson (Gell 1998, 65, figure 4.4/4) captures the complex interplay of ‘the shared biographical spaces of persons and images’ in remarkable detail.

We can accept as demonstrated reality the agency of artefacts and that objects can play sequences of varying roles in making people and places. However surely we must admit that much of the anthropological literature that we draw upon offers only analogy or inspiration rather than a directly applicable toolkit. Archaeologists, particularly prehistorians, cannot employ many of the methods of anthropology: learning the local language, written records, cultural immersion, structured interviews with people and so forth – our biological subjects are dead and our material subjects are dislocated from the flow of a living context. Joy (2009) expresses frustration, familiar to many, with archaeology papers that claim to integrate concepts of biography, cite the necessary references, and then baldly state that objects had rich social lives without venturing further. I would argue that a separation of theme and methodology is crucial when archaeologists cite the artefact agency and biography literature.

Several other academic disciplines aim to describe life events and the interplay of agents, and these alternative methods may be more applicable to the archaeological record. The rest of this paper briefly outlines some possible ways forward based upon the archaeometallurgy of Britain

and Ireland in the Early Bronze Age, drawing inspiration from recent techniques developed by early modern historians.

The scientific dataset for Early Bronze Age British and Irish copper-alloy artefacts

To discuss how we can write the biography of metal objects it is useful to first sketch a biography of the available academic data. The copper-alloy artefacts of Early Bronze Age (EBA) Britain and Ireland (c. 2300–1500 BC; Needham 1996) may be among the best characterised archaeological assemblages in the world, building on centuries of sustained research. Can this approach the ‘thick’ description of the objects that could parallel anthropological approach to biography, or do we need to look elsewhere?

In 1686 Robert Plot (see Plot 1973) wrote:

it is plain that all those places ... were sometime visited by the Roman militia, and were places of some action. And so for the same reason the parish of Ilam, where was found near the spring call’d St. Bertram’s Well, an instrument of brass, somewhat like (only larger than) a lath-hammer at the edg (sic) end, but no so (sic) on the other ... which I take to have been the head of a Roman *Securis* with which the Papae slew their sacrifices, notwithstanding it have no eye for the manubrium to pass through.

Though wrong in almost every respect, this antiquarian’s account of an Early Bronze Age axe is part of over three hundred years worth of sustained work on early British metallurgy. Perhaps surprisingly, the history of chemical analysis on these objects stretches back almost as far (Pollard 2015). There was a small community of scientists, or natural philosophers, in the late 1700s that were producing chemical analyses for copper-alloy artefacts. Though crude by modern standards this work was part of an intricate web of collaborations and discussions that ranged far beyond just metallurgy. Sometimes this breadth of knowledge was contained in individual people, for example Robert Plot was both the first Keeper of the Ashmolean Museum and Oxford’s first Professor of Chemistry.

The work of Pearson (1796) demonstrates an integrated methodology that we would still recognise, and encourage, today. To understand metal technology he combined experimental metallurgy (making alloy standards), testaments from classical sources, chemical analysis, archaeological context, and typology (through conversations with Rev. Lort and Sir Joseph Banks). The sixth object examined in his 1796 paper, is a ‘celt’ found by ploughing in a field in Cumberland (now Cumbria) ‘grooved on both sides to receive a shaft or handle’ (Pearson 1796, 403). This would now be defined as an Early Bronze Age low-flanged axe (Schmidt and Burgess 1981) from Needham’s metalwork assemblage VI (MA VI), approximately 1700–1500 BC (Needham 1996). Pearson

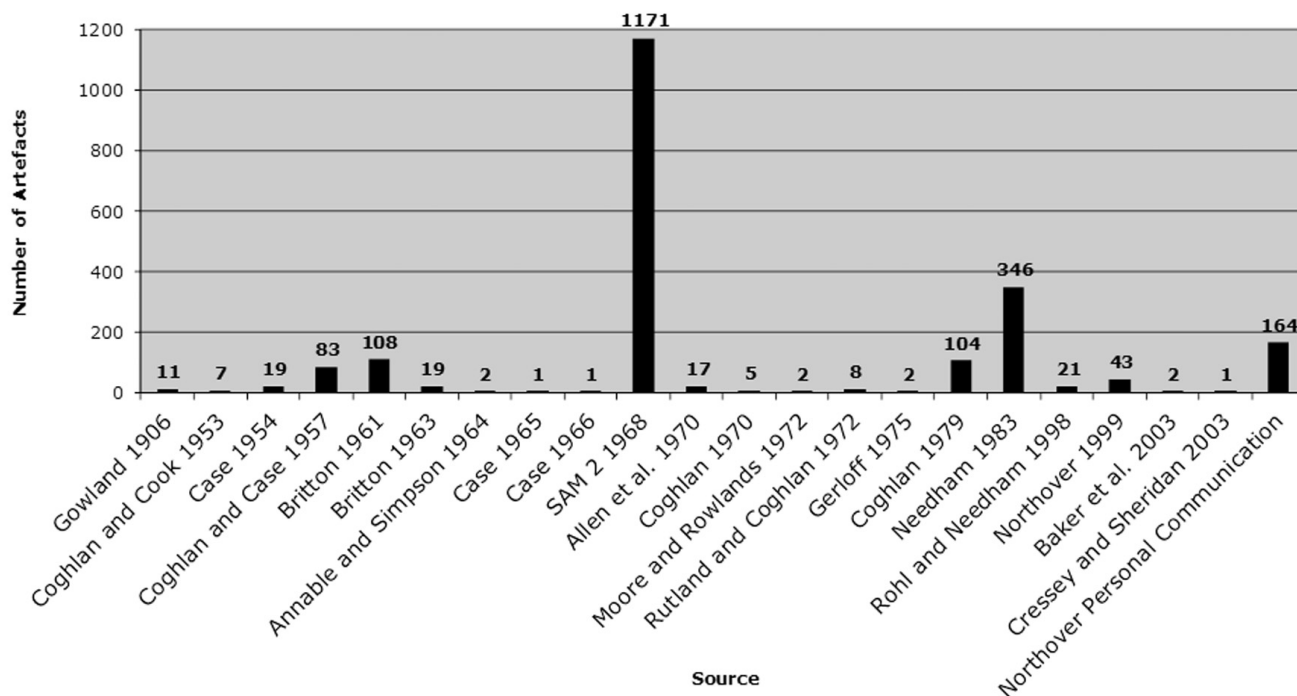


Figure 9.1 Early Bronze Age British and Irish artefacts: Number of chemical compositions first published by a source (papers often repeat earlier published analysis)

correctly defined the alloy as a high-tin bronze, and further said that it should not be called a brass, as this term must be reserved for zinc–copper mixtures.

The effort of hundreds of people, many unnamed in the records, has dramatically expanded the size of the recovered bronze assemblage and the quantity of scientific data on those objects. Figure 9.1 charts the influence of different papers for the chemical dataset (SAM refers to the *Studien zu den Anfängen der Metallurgie* projects, Junghans *et al.* 1960; 1968). It is hard to accurately gauge the size of the recovered copper-alloy assemblage for the British and Irish EBA, which mostly consists of halberds, axes, daggers, awls and small ornaments. We can combine estimates from key corpora and syntheses such as Harbison (1969), Gerloff (1975), Schmidt and Burgess (1981), Needham (1983) and Northover (pers. comm.) to arrive at a plausible figure of at least 4350, which is used in the assessments below. Of course the work of metal-detectorists in collaboration with the Portable Antiquities Scheme (<https://finds.org.uk>) is rapidly changing our dataset. Unfortunately assessing this impact is beyond the scope of this paper.

The range of analytical techniques that can help characterise metal and metallurgical processes has also increased dramatically. There is an alphabet soup of analytical approaches that can provide chemical analyses of varying quality (Pollard and Heron 1996). To this we can add isotopic approaches (principally lead, but increasingly other systems), hardness testing, optical metallography, and absolute dating of associated organics or production remains.

Unfortunately a method for directly dating the metal's smelt remains elusive, but research continues (Ioannis 2006).

The complete scientific dataset for EBA Britain and Ireland metals is rapidly increasing and is not simply defined. To be included in our working database the analysis (whether chemical, isotopic, hardness or a date) must be of sufficient quality that it can be reasonably merged with other high quality data. This is to say that the data's quality can be assessed, through defined measurement errors, clear protocols and so forth, and its inclusion would not bias or skew the archaeological assessment. The ideal is that different teams will each measure defined standards or the same archaeological objects so that any laboratory biases can be directly assessed. It is hopefully clear that the criteria for inclusion must be assessed on a question-by-question basis, for example some chemical datasets that can be included in studies of broad alloy shifts, must be excluded when discussing detailed nuances of trace elements.

The Oxford research group's ideal criteria for chemical data are that we wish to accurately assess the weight percentage of useful diagnostic elements in the copper-alloy objects (copper, tin, lead, arsenic, antimony, silver, nickel; see Bray and Pollard 2012; Bray *et al.* 2015 for further discussion and explanation). This means that our working database currently contains chemical analyses for 2130 EBA British and Irish objects, and these will be discussed below. This excludes the results of the pioneers of the 18th and 19th centuries, but these can be used with care for more qualitative work (Pollard 2015, 48). The earliest chemical data that is

This shows the % of artefacts that if you have tech A, go on to have tech B		Technique B							
		Chemical Composition	Non SAM chemical composition	Two Chemical Analyses	Metallography	Hardness Value	Pb Isotope	Absolute Date	
Technique A	Total Tech A	%: (A+B)/A	%: (A+B)/A	%: (A+B)/A	%: (A+B)/A	%: (A+B)/A	%: (A+B)/A	%: (A+B)/A	
	Chemical composition	2130	///	45.1	2.2	4.5	4.2	4.0	1.5
	Non SAM chemical composition	960	100.0	///	///	10.0	9.4	8.9	2.2
	Two Separate Chemical Analyses	47	100.0	///	///	21.3	19.1	17.0	2.1
	Metallography	97	99.0	99.0	10.3	///	75.3	4.1	1.0
	Hardness Value	90	100.0	100.0	10.0	81.1	///	3.3	0.0
	Pb Isotope Analysis	85	100.0	100.0	9.4	4.7	3.5	///	1.2
	Absolute Date	65	49.2	32.3	1.5	1.5	0.0	1.5	///

Figure 9.2 Percentage of artefacts that if you have tech A, go on to have tech B

of sufficient quality to be included here (with caution) are a handful of axe analyses by William Gowland (1906); though most of the dataset was produced much later (Figure 9.1).

Figure 9.2 shows the number of analyses for EBA Britain and Ireland for individual methods (see the column ‘Total technique A’) in Oxford’s working database. After the large volume of chemical analyses there is a rapid fall away, with around one hundred sets of metallographic descriptions, lead isotope values and hardness values, and 65 relevant radiocarbon dates that are in very close association with metalwork (again, this figure will be rapidly out of date). The data produced by the *Studien zu den Anfängen der Metallurgie* (SAM) projects (Junghans *et al.* 1960; 1968) are considered apart due to the project not publishing quantitative results for high tin levels (results over 10% tin were indicated by >10 in the documentation). This was due to the limits of the chemical analysis methodology they employed, optical emission spectrometry (OES). Therefore the non-SAM data is highlighted due to it being more informative on some aspects of high-tin bronze.

Aside from the chemical corpus this may seem quite a sparse dataset, but it is actually remarkably rich when considering the small chronological range and geographical area that they relate to. This is particularly driven home when comparing the British and Irish records to that available for the considerably larger area of China during the Shang and Western Zhou periods (Liu *et al.* 2015).

Overall in the Early Bronze Age of Britain and Ireland there is certainly sufficient density of scientific data to draw often very detailed conclusions about the history and behaviour of groups of objects (Allen *et al.* 1970; Tylecote 1986; Needham 1988; Northover 1999; Barber 2003; Bray 2009). However, does this density allow the regular application of biographical interpretations?

The structure and density of the Early Bronze Age dataset

A full biography of an object requires a number of techniques to be applied to it, each providing their particular perspective to the artefact’s lifetime. These multiple overlapping approaches can be described as a high density of data. It is clearly possible to apply the full suite to an artefact when the funding, time, and political will are available. The Gundestrup Cauldron has, for example, received such attention, including innovative techniques rarely applied elsewhere such as lead isotopes in tin (Nielsen *et al.* 2005 is the complete study, see p. 38 for the work on lead isotope ratios from tin). However in practical terms this weight of information gathering is a vanishingly rare occurrence. We can apply a simple scoring system to the EBA Britain and Ireland artefacts to gauge the richness and dispersal of coverage. Figure 9.3 explains the scoring system, which covers chemical analysis, including repeat analysis to assess

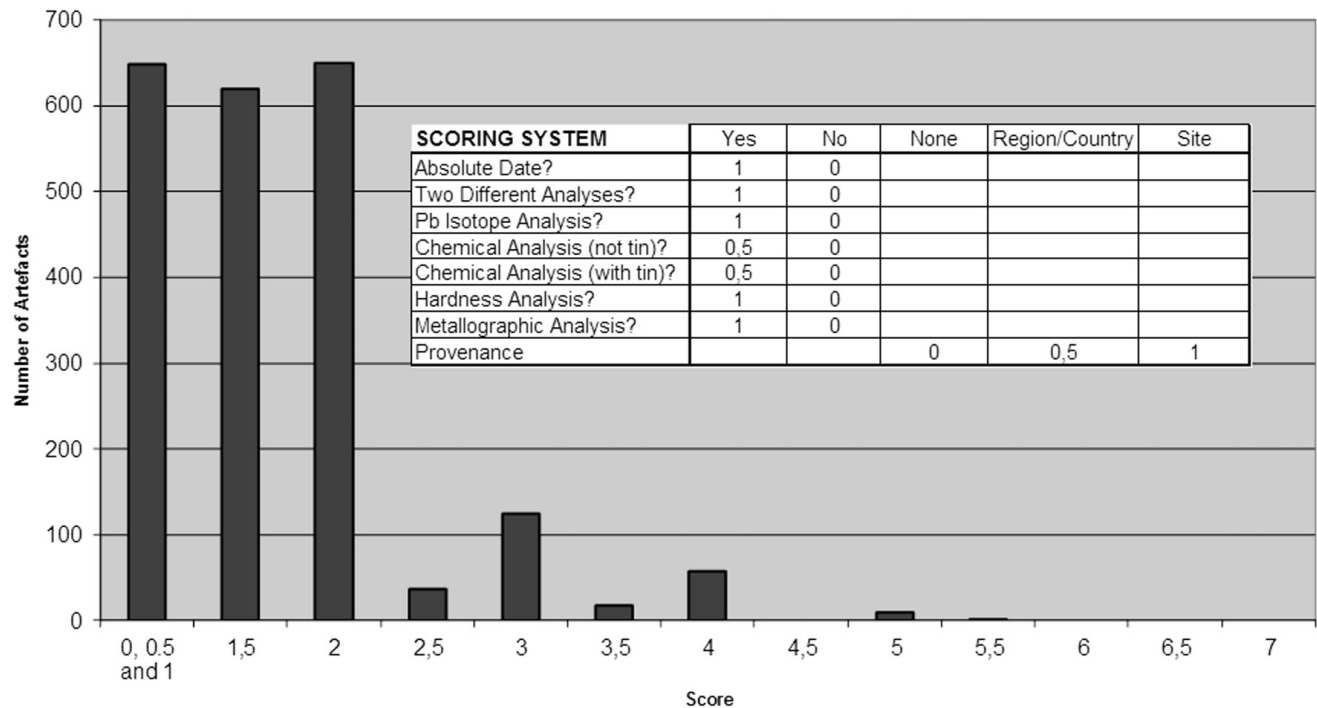


Figure 9.3 British and Irish Early Bronze Age copper alloy artefacts: Scores for scientific analysis

accuracy and variation, metallographic analysis, hardness testing, lead isotope analysis, independent absolute dates, and the level of provenance that is known. A scale is used to distinguish varying degrees of provenance information. For the chemical analysis half a point is given if the alloy can be determined, and half a point if the trace elements are accurately recorded. A high quality chemical analysis would therefore gain the whole point.

For British and Irish EBA copper alloy objects, it is clear that despite over a century of intensive archaeological and scientific work (see above) the data density of the assemblage is very low. Figure 9.3 provides the scores for all artefacts that have received some scientific attention, 2162 in total (2130 of which received a chemical analysis). With an approximate total recovered copper-alloy assemblage of 4350 (with the caution expressed above) this means around 2200 objects have received no scientific intervention. Of the artefacts with at least one scientific test (Figure 9.3), approximately 90% have a science score of 2 or below. This low level is caused by a combination of extremely poor provenance for many objects and chemical analysis being the only applied technique. Around 60% of all Irish EBA copper-alloy artefacts can only be provenanced to the level of 'Ireland', which obviously severely restricts any kind of regional study or innovative geographical work. For the chemical results we often have an extremely poor understanding of tin level due to the restrictions imposed by *SAM* data (see above), this leaves many artefacts with a 0.5 score for chemistry. Only around one percent of the

total assemblage has a score of 4 or higher, none approach 7. This severely undermines a straightforward application of the biography concept to the corpus at large; the data available cannot sustain it.

The highest scoring artefact is a copper flat axe (Needham Metalwork Assemblage I–II, 1996) held by the National Museum of Wales, inventory number 21.24.21, from the historic county of Merionethshire (a more secure provenance is not available). This axe was included in Rohl and Needham's (1998) lead isotope project, it has been analysed by different chemical analysis teams (Britton 1963; Northover 1999), and received metallographic and hardness testing (Northover pers. comm.).

As well as data density, we can assess the 'clumpiness' of the data; how far different techniques cluster together. Returning to Figure 9.2, the technique A column presents the number of different types of analysis that have been performed. The second section of the figure provides the percentage of artefacts that after analysis by technique A have then been analysed by another, technique B. For example, reading across from chemical analysis (2130 total), 4.5% of those artefacts also have metallographic descriptions.

There is some structure and clumping within the scientific data, and for the EBA dataset this is particularly true for composition analysis, hardness values and metallography, which are often seen as a united analytical suite (Scott 1991). For artefacts with a hardness value, 81.1% also have been studied metallographically. However it is more

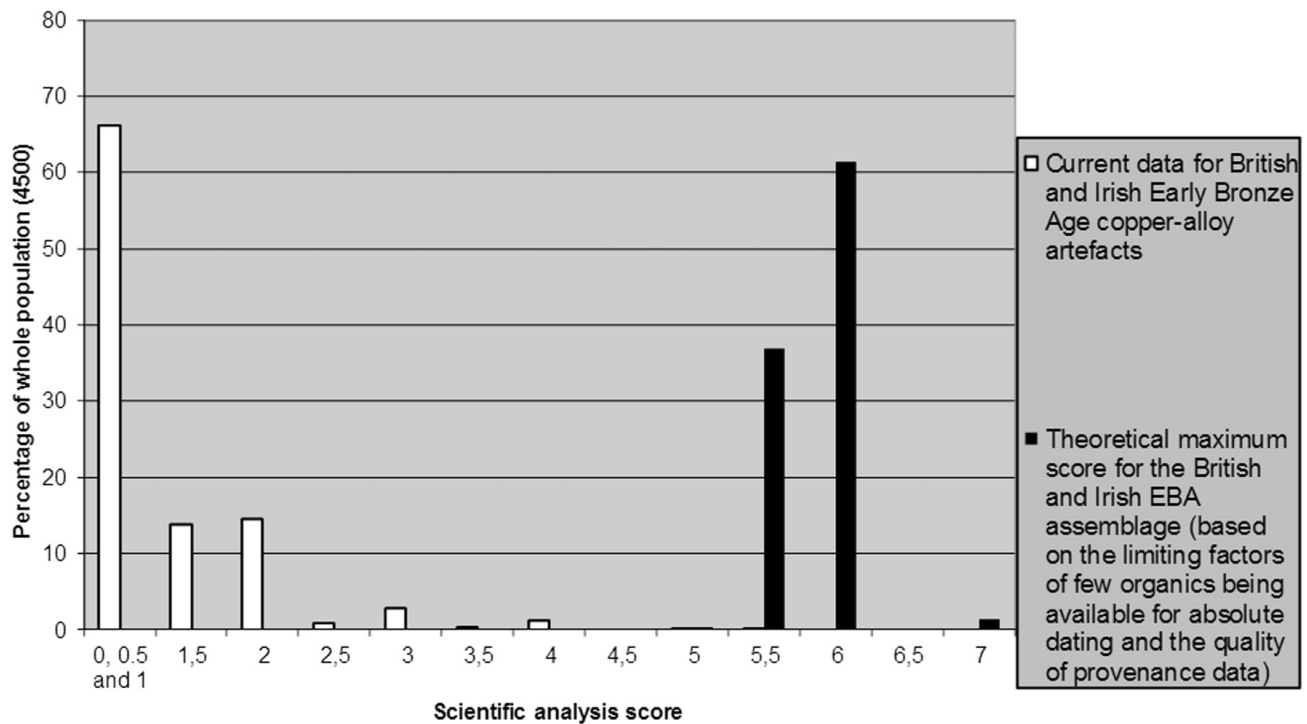


Figure 9.4 All British and Irish Early Bronze Age copper alloy artefacts: Level of scientific analysis applied to each artefact

rare to find metallography associated with lead isotopes, for example only 4.7% of objects with lead isotope values have metallographic descriptions. Surprisingly only half of the artefacts linked intimately with a radiocarbon date have a known chemical composition. It would seem that these artefacts should be high priority targets for further investigation. Overall, the occasional clustering of approaches means that the few outline biographies we can infer, those with relatively high scores in Figure 9.3, will usually tell the same limited stories.

Due to financial constraints and the obvious difficulties of applying destructive analytical techniques to large datasets it is difficult to see how scientific archaeometallurgy will approach a significantly higher density of data. Figure 9.4 models the possible maximum scores for the whole artefact assemblage: c. 4500 artefacts. Even if the money and permissions necessary for scientific investigation were received, which is *extremely* unlikely, we would still be hampered by a lack of provenance information and the challenge of applying absolute dating methods to metals. Writing overlapping series of individual object biographies are impossible.

The use of prosopographical methods to understand early metal

Archaeologists do not use several anthropological methods for investigating biological agents, as ours are obviously long-deceased. Similarly we may need to be more explicitly

archaeological in our approach to *non*-biological-agents, while retaining the themes of agency, materiality, and life-events. There is a field of study that has already faced these challenges of dead agents and fragmented, diffuse datasets, and produced an innovative solution. Prosopography is a methodological framework developed in by historians over the last century, which is designed to build rich, multi-layered narratives from very fragmented written records (Keats-Rohan 2007). A prosopographic study is, in many ways, at right angles to the 'biographic' approach that can only be developed for the singular and elite about whom detailed records remain. Though sometimes described as 'collective biography', it is actually a very different research approach to writing a self-contained narrative. Instead, all attested, unique individuals are logged (often including a large, anonymous minority), and then biographical fragments are hung upon this framework. So any brief mention in a will, census, contract, street listing, guild membership, birth, christening and death records (and so on) are placed into a digitised, relational database. Many thousands of people are only briefly mentioned once in the entire historical record, but through synthesising all such records, of different types, those fragments of attested life can be put to use (Stone 1971; Keats-Rohan 2007).

The word prosopography is taken from the technique *prosopopeia* in classical rhetoric in which an absent person is described into being, the 'face created' (Stone 1971). It is based on admitting that –specifically for the written word

within the field of history – the vast majority of human life can only be inferred from cobbling together different sorts of texts to build a more telling abstraction. Prosopography puts these biographical fragments in parallel and uses the entire dataset to build up an impression of past behaviour through comparisons, synthesis and statistical analysis. For example, in recent years historians have assembled prosopographic databases for the Neo-Assyrian Empire (<http://www.helsinki.fi/science/saa/pna.html>, a multi-volume work beginning with Radner 1998) and to develop a better understanding of the origin and descendants of all persons mentioned in the *Domesday Book* (<http://prosopography.modhist.ox.ac.uk/coel.htm>, Keats-Rohan 1999). More recent projects include the *Prosopography of Anglo Saxon England* (PASE, <http://www.pase.ac.uk>), and the *Prosopography of the Byzantine World* (PBW, <http://blog.pbw.cch.kcl.ac.uk>).

In these cases, databases were designed to pull together highly fragmentary textual sources about tens of thousands of individuals, which then allow for statistical historical interpretations at a number of scales. These still include the rare richly attested lives such as Bede's *Life of Cuthbert*, but can also focus on the wider pool of the population for whom the biographical fragments are far more diffuse. Rather than allow unusual and outstanding individuals to dominate the discourse, prosopography uses the complete mass of data as a starting point to see underlying structure and connections.

Prosopography already occurs, to a certain degree, in archaeological studies as we are forced, by necessity, to work with fragmented data and compensate for gaps and biases. It would appear to be an ideal framework to help systematically blend the biographical fragments afforded by different analytical approaches to early metal. Rather than birth date, land deeds, baptism and so forth, we have biographical fragments for objects such as chemical source, use-wear pattern and the context of deposition. Rather than discard isolated, understudied artefacts as they cannot contribute to thick biographical narratives, the complete assemblage works together. The central theoretical concerns of agency, materiality and intertwined lives are maintained, but working *with* archaeological techniques and the challenges of our record. An object-prosopography database has already been created from the data summarised in the figures, with promising initial results (Bray 2012; 2016; Bray and Pollard 2012; Bray *et al.* 2015). The case studies explored in these papers range across geographic scales, time scales and object classes, all linked through a GIS linked database.

Recent work at Oxford, including the *FLAME* project (*Flow of Ancient Metal through Eurasia* project, <http://flame.arch.ox.ac.uk>), aims to expand and implement further archaeological prosopographies, in this case for the Bronze Age dataset for copper alloys across Eurasia. It is possible to envisage prosopography being a reasonable framework for other non-biological agents such as landscapes. Of

course this highly synthetic approach is challenging to implement and requires computing power, careful database design, and statistical insight as well as the energy and vision to assemble a number of otherwise only marginally related data-points. As a structural approach to archaeology, prosopography has the potential to allow us to work with, rather than around, the holes in our data and build models that utilise readily available, but long-neglected, legacy datasets. Instead of generalising outwards from exceptional objects with clear archaeological contexts that are in no way representative of the general archaeological record, this approach incorporates all objects, including the mundane.

Conclusions

In conclusion, this paper has tried to blend concepts from recent theoretical concerns in material culture studies, with practical and pragmatic experience concerning the analysis of the earliest copper-alloy in Britain and Ireland. This dataset has a number of strengths to support new practical applications of material agency concepts. There has been a long history of relatively intense study on EBA metallurgy from social, archaeological, metallurgical and conceptual directions. This required the application of a wide range of techniques, many of which provide insight into processes and context, which can be interpreted as biographical fragments and 'life episodes'. Indeed, in the many syntheses of early metallurgy in Britain and Ireland authors commonly show cycles of metal use, *chaîne opératoire* and schematic models of exchange and deposition.

However, these advantages do not allow the straightforward adoption of rich, biographical models of artefacts that are drawn from recent anthropological and sociological research. The datasets are rich, but widely spread out and disjointed, so that there is not a large number of artefacts with dense overlapping datasets. When the data does clump it is in small amounts and often in the same combinations, for example the suite of chemistry-hardness testing-metallographic description.

The biography of artefacts is obviously a big hit within archaeological research, however within this literature there is often a focus on highly prized objects such as Iron Age mirrors (Joy 2009) and the Gundestrup Cauldron (Nielsen *et al.* 2005). There are also hints of frustration that the nature of the dataset reduces the application of biography to a superficial level. One further challenge that has only been lightly mentioned in this paper is the time scale over which biography acts, the quick fluctuations of influence, reception and change that Gell (1998) records are a world away from typo-chronology and calibrated radiocarbon dates.

The development of archaeological prosopography appears to be a promising candidate for drawing on all archaeological data and themes of current theory, but within a pragmatic and practical framework. History has

had struggles with fragmented data and poorly attested agents that will be familiar to all archaeologists. Their solution of carefully constructed relational databases will also be familiar. We need to continue to develop distinctly archaeological interpretative tools that link social processes, life events, material culture and our dataset. The rich prosopographical literature is an underutilised tool in this area. Dialogue and cross-fertilisation between different specialisms is straightforward; it is the dataset itself that undoubtedly poses the most difficult challenges, no matter how strong it is.

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Chapter 10

The role of pre-Norsemen in trade and exchange of commodities in Bronze Age Europe

*Lene Melheim, Johan Ling, Zofia A. Stos-Gale, Eva Hjärthner-Holdar
and Lena Grandin*

Introduction

The origin of the raw metals used to make metal artefacts has been a great concern in Bronze Age studies, and even more so after lead isotope analysis was introduced as a method for provenancing archaeological metals (Gale and Stos-Gale 2000). Recent developments within the archaeosciences have been famously described by Kristian Kristiansen (2014) as the third science revolution in archaeology: The first revolution being the evolutionary archaeology of the 1850–60s, headed by Oscar Montelius, the second being the radiocarbon revolution, and the third the current advances in aDNA and stable isotope analysis. Although indeed saluting this development, Kristiansen rightfully states that: ‘There is still some way to go before these scientific landmarks are fully calibrated and precise’ (Kristiansen 2014, 13–14). With this statement he compares the current state of the third revolution to the consolidation phase after ^{14}C had been introduced and applied, when the shortcomings of the method were being analysed and corrected.

A range of unresolved problems will be familiar to the reader, when it comes to current scientific methods and data used to test the origin of raw materials. Strictly speaking, a provenance hypothesis for copper, silver or lead can never be conclusively verified through lead isotope analysis, only falsified (see *e.g.* Hauptmann 2007, 34). On the other hand, with the availability of extensive trace elemental and lead isotope databases of copper ore deposits and Bronze Age metal artefacts, there is a good chance of selecting a limited number of possible sources of copper for a given artefact (Stos-Gale 2016). A perhaps more pertinent problem for many regions is the lack of reference data that includes both lead isotope and chemical analyses (Stos-Gale and Gale 2009; Pernicka 2014). This problem is often not sufficiently bolstered in provenance debates. A third point

– also well-known to the scientific community – is that in order to establish a reliable match between objects and ores and back up a theory of provenance, other, direct and circumstantial evidence is needed. Clearly, reliable mine-metal-object connections should be sought (*e.g.* O’Brien 2004; Williams 2015; 2017). However, this also means that there is an overwhelming risk of circular reasoning, if for instance, potential ore regions are ruled out, regardless of the state of research in that area and consequently rejected on the basis of lack of *knowledge* about mining in the area and not on the basis of conclusive negative evidence (Melheim 2015, 155–60).

What is less often questioned is the *relevance* of provenance, or, what provenance can actually say about past relations. It has been pointed out that due to the visual anonymity of metals, a concern for origins in the Bronze Age would first and foremost have to do with the quality and style of the crafted metalwork (Fontijn 2009). Even to the craftsman provenance may not have mattered beyond whom he got the metal from, perhaps the last trading partner in a long chain of actors. While this may of course be true, we find the origin of the raw materials highly relevant for a broader understanding of the Bronze Age world. Far from stating that provenance is irrelevant, this article therefore aims at illuminating the complexity of the human relations involved in the exchange of metals.

Returning to Kristiansen’s point about the need for calibration of revolutionary methodologies, it is clear that when it comes to the currently used provenance methods, a calibration is necessary also when it comes to the applied explanatory models and theories. Lead isotope ratios and other data from scientific analysis are of little value as indicators of provenance, if we are unable to reconcile them with valid archaeological theories. This simple and perhaps

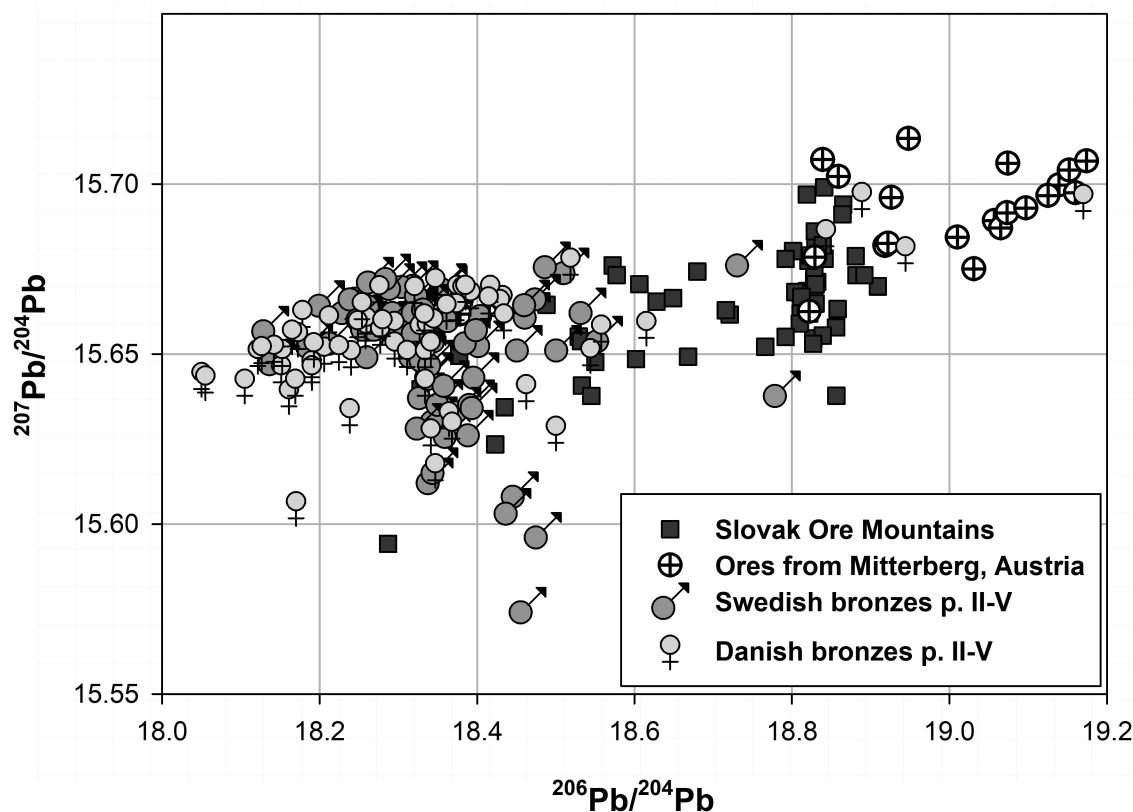


Figure 10.1 The majority of lead isotope ratios for the Scandinavian bronzes dated to Montelius's periods II–V fall into the range of the $^{206}\text{Pb}/^{204}\text{Pb}$ values of 18.05 and 18.35. Copper ores (sulphides) of such geological ages are not found in the Carpathians or the Austrian Alps

uncontroversial point also means that scientific data may sometimes challenge established theories to the degree that we must seriously reconsider old 'truths'.

A pronounced shift in metal supplies around 1500 BC

The collapse of the Únětice culture and rise of the Nordic Bronze Age coincided around 1600 BC, or, at the transition from Montelius's period Ia–Ib (Vandkilde 2014). At the same time, there is an increase in recovered metal objects in Scandinavia (Vandkilde 1996, 262–64, fig. 279). From now on, locally-made metal objects by far outnumber imported objects, and a distinguished stylistic repertoire is developed in the Nordic region. This, and the fact that metal workshop finds increase in size and numbers from c. 1500–1300 BC (Melheim 2015, 20–24), seem to indicate that local metal workshops were the main providers of bronze objects to the Nordic societies.

Between 2010 and 2017, four interrelated Scandinavian projects formed a large collaborative program, among the most extensive ever launched in Europe using lead isotope and chemical analysis in combination. Nearly 400 bronzes dated to 2000–500 BC have been included. It should be stressed that not all available data have yet been published.

Besides, newly published data for the ores from the Austrian Alps (Mitterberg), Slovakia and the Italian Alps (Schreiner 2007; Artioli *et al.* 2014; 2016; Pernicka *et al.* 2016), have led to a reinterpretation of some of the previously published results (Ling *et al.* 2013; 2014). From this, a new picture is emerging, which partly contradicts established theories about metal provenance (e.g. Liversage 2000).

The bulk of the analysed copper-based artefacts dated to 2000–1500 BC are interpreted to have their copper sources in the Slovak Carpathians (Spania Dolina), the British Isles (Wales, Great Orme) and to some degree North Tyrol (Mitterberg) and the eastern Mediterranean (Ling *et al.* 2014; Vandkilde 2017, 141–43, 205–12; Melheim *et al.* 2018).

However, around 1500 BC, a clear shift may be noted with copper coming in from sources previously not identified in the Scandinavian data-set. The bronzes dated to 1500–1100 BC are mainly low impurity bronzes, with nickel and arsenic as main impurities, probably indicating that the copper was smelted from sulphide ore sources, such as chalcopyrites, or oxidised ores. A comparison of Scandinavian bronzes dated to 1500–700 BC with lead isotope ratios for copper ores from the Austrian Alps, and the Slovak Carpathians, shows that there is a considerable group of bronzes that are definitely not consistent with these ores (Figure 10.1/Colour

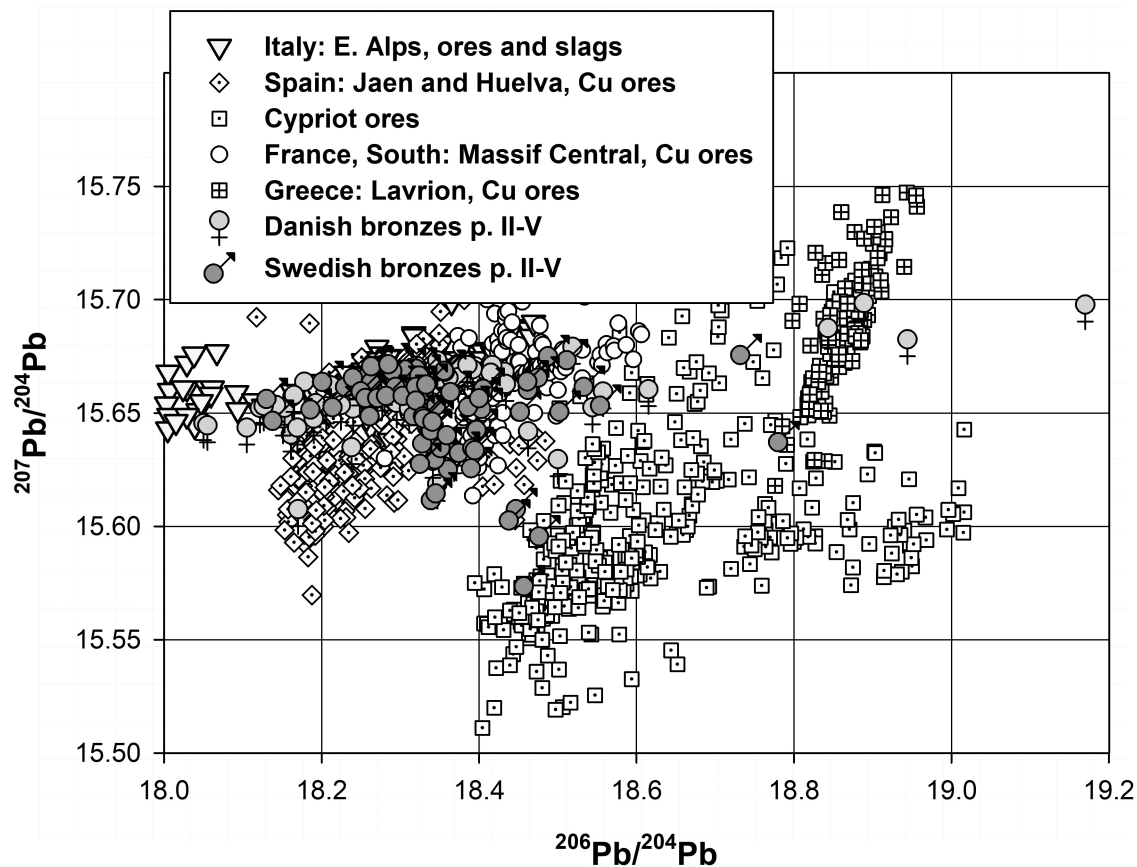


Figure 10.2 The lead isotope ratios for Scandinavian bronzes dated to Montelius's periods II–V are mostly consistent with ores from the Eastern Italian Alps, as well as Jaén and Huelva in southwest Spain

Figure 10.1). Neither do the Scandinavian objects plot with objects suggested to originate from local ores in North Tyrol and the Carpathians (Pernicka *et al.* 2016). Many of the Scandinavian objects have lead isotope ratios falling quite convincingly with copper ores either from the eastern Italian Alps (south Alpine) or Southern Iberia (Iberian Pyrite Belt and other ore bodies *e.g.* in Sierra Morena) (Figure 10.2/ Colour Figure 10.2). The initial interpretation of the Swedish data-set (Ling *et al.* 2014) suggested that copper ores in southern Spain and Sardinia were potential sources to a large part of the bronzes from this period (and continuing into the 10th century BC). However, new reference data from the Italian Alps demonstrate that ores in this region partly overlap with the isotopic fields for the Iberian ores and provide better matches with the Scandinavian data-set, and as a consequence, some of the initial interpretations are now being revised. It must be noted, however, that some of the Spanish ores in Andalusia and the Alcadia valley are inseparable from ores in the Italian Alps isotopically (Artioli *et al.* 2016), and that these ores cannot be distinguished on the grounds of chemistry.

While the Iberian Peninsula is one of the richest metalliferous regions of Europe and evidence of local,

prehistoric copper industries is ubiquitous from the 3rd through to the 1st millennium BC, comparatively few mining sites have been securely dated to the Bronze Age (Hunt-Ortiz 2003; Bartelheim 2007, fig. II. 7; Bartelheim and Montero-Ruiz 2009, 10; O'Brien 2015, 77–104; Montero-Ruiz 2017). The Iberian Pyrite Belt in southwest Spain and adjoining regions in Andalusia were important mining regions during the Chalcolithic and in the Late/Final Bronze Age from *c.* 1200 BC. The recent identification of Linares copper at Cogotas I sites in central Spain does suggest, however, that mining occurred in Andalusia also in an earlier part of the Late Bronze Age (Galindo *et al.* in press). Many scholars have argued that Bronze Age metal production was inherently local and not aimed at exportation beyond the regional catchment area until the Late Bronze Age, when the Iberian Peninsula became fully integrated into long-distance trade networks (Bartelheim and Montero-Ruiz 2009; Murillo-Barroso and Montero-Ruiz 2017). Our results, pointing to the possibility of metal exchange with Scandinavia already *c.* 1500 BC seem to challenge this view.

Another significant result of the provenance studies is the lack of strict correlation between metal compositions

and object typology. Whereas stylistic similarity between the Nordic region and Central Europe and the Carpathians is naturally seen as an effect of strong cultural ties, these two regions seem to diverge when it comes to ore sources. While traditional theories about the origin of Scandinavian copper often stressed the idea that regions that shared metal forms and styles also shared ore sources, the new results tend to modify this assumption. This has implications for our interpretative models, *i.e.* how we should regard exchange networks in the Bronze Age.

Previous attempts at mapping dominant zones of interaction in the early 2nd millennium BC emphasise terrestrial routes between Scandinavia and the eastern Mediterranean area, while there seems to be no connection at all between Scandinavia and Iberia (Kristiansen and Larsson 2005, 211, fig. 96; Vandkilde 2014). While earlier theories of provenance lingered on stylistic and cultural resemblance with the copper-producing areas of Central and Eastern Europe, our interpretations of the metal analyses suggest that the old terrestrial and river-based communication routes across the European Continent were not the only transport routes for metal to Scandinavia.

Indeed, our results also suggest that at least some metal must have arrived in Scandinavia as raw metal in the form of ingots (Ling *et al.* 2014; Melheim *et al.* 2016), and not just, as was previously assumed, as already alloyed bronze (*e.g.* Montelius 1878, 33; Liversage 2000). The use of unalloyed copper and tin (and precious metals) by the northerners is furthermore supported by analyses of crucible residues (Oldeberg 1960, 41–42; Högborg 2011; Melheim *et al.* 2016). The Salcombe wreck site off the coast of Devon, England, is an instructive case (Needham *et al.* 2013). Here we see evidence of trade in a variety of products; ingots, scrap metal and foreign objects (Needham and Giardino 2008). We find it likely that a combination of different products, raw metals, objects and scrap metal was traded to Scandinavia.

Within Scandinavia, the often coastal and strategically oriented location of the metal workshops producing for larger areas (and transforming raw metals into culturally acceptable exchange products) is another strong indication that the transportation of metals followed sea-based routes (Melheim and Ling 2017). While possible interaction with groups in the Italian Alps will be further explored in another article the focus here will be on coastal relations between the northerners and the Iberian Peninsula. In a previous article focusing on the interplay between regions (Earle *et al.* 2015), we argued that Iberian copper may have reached Scandinavia from c. 1500 BC through an Atlantic network. Here, we want to explore the possibility that the connection between Scandinavia and Iberia was of a more direct kind.

The archaeological backdrop

Recent aDNA studies have underpinned the theory of a spread of the Yamnaya from the Black Sea into Central

Europe, then blending with local Neolithic farmers into the Corded Ware Culture and serving as the gene pool for Neolithic and Bronze Age populations of Central and Northern Europe (*e.g.* Allentoft *et al.* 2015; Haak *et al.* 2015). This new aDNA evidence may suggest that the strong ties between Central/Eastern Europe and Scandinavia that we see in the Bronze Age were perhaps based on notions of origin and cultural/kin affinity established already in the 3rd millennium BC, with the migration and spread of the Corded Ware and Bell Beaker Culture. The similarities in metalworking styles between the two areas in the Bronze Age indicate a continuation of this scenario – a contact which, on the basis of the common stylistic *koiné* (Vandkilde 2014), may be expected to be based first and foremost on cultural ties (personal alliances and gift-giving). The many import objects from the Carpathian Basin entering Scandinavia are, however, soon accompanied by local imitations. Some of these, *e.g.* the swords from Dystrupgård in Denmark, despite being stylistically very close to the Håjdusámson-Apa metalwork seem to have been made of metal originating in the British Isles, quite probably Wales (Melheim *et al.* 2018).

From the 16th century BC, Europe saw the emergence of a strong correlation between traders and warriors, and it seems that the long-distance mobility that characterised this social configuration influenced central and peripheral regions alike (Kristiansen and Suchowska-Ducke 2015). Around 1300 BC new dramatic events led to substantial migrations across Europe, probably related to the emergence of a new warrior elite during the Urnfield period, and with evidence of substantial contribution of non-locals to the warrior bands raiding Central Europe (Kristiansen and Suchowska-Ducke 2015, 373–74). The wide distribution of Naue II swords from Scandinavia to the Balkans and Mycenaean Greece is a clear indication of this (Kristiansen and Suchowska-Ducke 2015, 374, fig. 5). The spread of the Naue II may even suggest that there was a connection between trading and raiding, or that the roles of merchant and mercenary sometimes overlapped.

One of the strongest assets of the emerging Nordic Bronze Age societies was their capacity for overseas travel and maritime adventures, if we are to judge from the high frequency of boat depictions in rock art. Seafaring skills and boat technology may have been a comparative advantage in the interregional metal trade (Rowlands and Ling 2013; Earle *et al.* 2015). While the oldest boat finds in Scandinavia date to the Pre-Roman Iron Age, rock art images allow us to transpose this boat technology – plank-built boats – back into the Bronze Age and beyond. The capacity of a reconstructed Hjørtsspring boat (dated to 375 BC) is illuminating: with trained paddlers it goes with a speed of 4 knots covering daily distances of up to 80–100 km, and can take 500–1000 kg of cargo (Crumlin-Pedersen 2003, 103, *cf.* Earle *et al.* 2015). This means that a boat with trained paddlers from Jutland in southern Scandinavia could reach

the north of Spain in about 30–35 days with good weather. For a sailing craft, the trip could take less than 20 days.

The establishment of maritime institutions on the Scandinavian Peninsula c. 2500 BC with the development of plank-built boats aimed at overseas travel, is likely to have led to the formation of new socio-cultural units or ‘crews’ that we see evidence of in rock art (Cornell and Ling 2010). The crews of the war canoes were, however, more often than not armed, perhaps not unlike the *leiðangr* of later history (Glørstad and Melheim 2016). This corresponds with the development elsewhere in Europe, and the Nordic maritime crews may not be so far from the Southern European trader-raider described above, operating very much like the later Vikings (cf. Kristiansen 2007; 2016). Furthermore, this suggests that the agents that participated in the Atlantic trade were part of a rather exclusive group of travelling traders and warriors (cf. Kristiansen and Larsson 2005, 246–50; Bachuber 2006).

The ability to fund boat-construction provided a new choke point based on the ownership of ships, which favoured the rise of maritime chiefdoms in Scandinavia (Earle *et al.* 2015). The fact that more metal circulated in Scandinavia between 1600 and 1100 BC than ever before, probably relates to the elite’s capacity to invest in ships and crew. The societies in the north created new maritime institutions which enabled them to enter and participate actively in the maritime exchange networks of the Nordic Bronze Age. One aspect of this were seasonal aggregation sites, with trade, craft production and feasting, often situated in areas with congregations of rock art (Melheim and Ling 2017).

Direct long-distance trade?

Exchange in its widest sense may be considered to involve a flow of information across cultural boundaries (Renfrew 1975, 4–7). A crucial point emerging from current research is that trade and gift-exchange are coexistent and often interlinked and that there is no such thing as a water-tight division between the two (see *e.g.* Oka and Kusimba 2008). Objects can shift easily from commodity to gift or vice versa. Often, this occurs when they move across a cultural boundary (*e.g.* Vandkilde 2005). From this follows that a transformation of value will be necessary between parties belonging to different economic systems or spheres. Using Marshall Sahlins’s three main concepts of reciprocity (Sahlins 1972, 191–96), we suggest the following three scenarios:

- Generalized reciprocity (gift exchange only) reflects social and/or cultural affinity and vague obligations. There’s no need for immediate return nor a transformation of value;
- Balanced exchange including gift-exchange and purchase with primitive money; (balanced or symmetrical reciprocity) reflects larger social or cultural distance and a need for return. The exchange is driven by individual

interest and some form of transformation of value may be assumed;

- Negative reciprocity includes profit-driven exchange, barter and even theft and is the most impersonal form of exchange, based on cultural distance, and with interested parties seeking to maximize their gains. A transformation of value is to be expected.

While outside the chronological scope of this article, a few examples of early north-south exchanges point to connections between Spain and Southern Scandinavia in the 3rd and early 2nd millennia BC. To date, one single piece of Chalcolithic amber has been identified as Baltic, deriving from a dolmen in the Basque country in northeast Spain, and interpreted as evidence of sporadic exchange contacts between local and foreign elites (Murillo-Barroso and Montero-Ruiz 2017, 277–80). Another example is a Spanish find of a Nordic flint dagger of the fish-tail type dating to c. 1950–1700 BC (Suárez Otero 1998, 136, pl. 22; Frieman 2012, 447). It is interpreted as an example on how communication and exchange could be facilitated through ‘boundary objects’ (the concept of the dagger, regardless of whether it was made from copper or flint), bridging people with different backgrounds (Frieman 2012). Similar finds from the British Isles (Clark 1932) again suggest that these daggers were traded within an Atlantic network. These finds may be interpreted as instances of generalised or, perhaps more likely, negative reciprocity.

Substantial evidence of cultural contact between northern groups and west Mediterranean groups is seen from around 1300–1200 BC, for instance in rock art – with similar motives occurring *e.g.* in Spain and Scandinavia. If we follow the above logic, while few signs of cultural connections in the first phase (before 1300 BC) may be explained as an indication that the exchange of metals was primarily indirect, or, based on negative reciprocity, the ensuing phase shows evidence of stronger cultural integration, perhaps as an effect of established exchange relations and balanced reciprocity, likely to include both gift-exchange and trade.

Two main models of sea-based interaction between Scandinavia and the western Mediterranean are feasible:

- Multi-line trading between several parties operating within the larger Atlantic networks with the British Isles as a ‘hub’;
- Long-distance travels conducted by one of the parties – with northern ships sailing southwards or southern ships sailing northwards, or, traffic both ways.

On the basis of the comparative advantages of different regions, Earle *et al.* argued that long-distance trade and bottlenecks in commodity flows were driving factors in the political economy of the Bronze Age. However, we opted for multi-line trade between Scandinavia and the western Mediterranean (Earle *et al.* 2015, 642). The lack of cultural



Figure 10.3 The Spanish axe-shaped ingot from Sweden (Photo by Lena Grandin. Reproduced with the permission of Göteborgs Stadsmuseum)

influence seen in the incipient phase of metal exchange in the 16th century BC is well understood as an aspect of a multi-party down-the-line type of exchange. Direct long-distance travel seems, perhaps, at first glance to be more unlikely. Nonetheless, we suggest here that a model of direct long-distance trade is in fact a plausible explanation for developments in the later phase, when cultural ties emerge between Scandinavia and, for instance, Spain.

The theory of long-distance exchange based on cultural connections may be backed up with evidence of two-ways exchange, i.e. finds of assumed Iberian origin in Scandinavia. An illustrative example is a palstave from Lake Tåkern in Sweden (Figure 10.3/Colour Figure 10.3). This particular type of axe, a double-looped palstave, often occurs in the Galician area and dates to 1250–900 BC (Monteagudo 1977, Taf. 86, 87 and 100). Already in the 1920s Arthur Nordén emphasised the importance of this find, and what he saw as similarities between Scandinavian and Iberian rock art (Nordén 1925, 115). Even Gordon Childe expressed interest in the palstave. The Tåkern palstave constituted in his opinion the northernmost example of an axe type occurring in, for instance, southern England, western France and Sardinia (Childe 1939). The object is more accurately defined as an axe-shaped ingot than a functional axe. The not yet published analyses of this axe show clear consistency with Iberian artefacts both in terms of lead isotopes and chemistry (however not the same ores as identified in other Scandinavian metalwork argued to originate from Spanish sources).

Moreover, it is interesting to notice that two Herzsprung shields from Fröslanda in western Sweden have lead isotope and chemical compositions consistent with copper ores in the Iberian Pyrite belt in southwest Spain (Ling *et al.* 2014). These shields of so-called U-notched type are dated to c. 1100–800 BC (Uckelmann 2012, 50–62, 127–37). Interestingly, a large number of Extremaduran stelae (46 examples) have depictions of Herzsprung shields (Harrison 2004, 124). Although most of them are of the so-called

V-notched type and slightly later, a few representations of U-notched shields are also known (*cf.* Uckelmann 2012, 129, fig. 15b). The distribution of V- and U-notched Herzsprung shields has a clear Atlantic pattern, stretching from Iberia, via the British Isles to Scandinavia, but variants occurring even in Sardinia and Greece (Hencken 1950; Gräslund 1967; Uckelmann 2012, 50–62, 127–37, pl. 160).

Examples of goods passing from north to south are most notably prominently represented by finds of Baltic amber on the Iberian Peninsula (Murillo-Barroso and Martín-Torres 2012) and elsewhere in the Mediterranean region (Kristiansen 1998, 233, 378; Mukherjee *et al.* 2008; Kaul 2013; Angelini and Bellintani 2017). In Iberia, Baltic amber has been identified in both Early and Late Bronze Age contexts, but with a shift from the northern to the southwestern part of the Peninsula during the 1st millennium BC (Murillo-Barroso and Martín-Torres 2012, figs 9–10; Murillo-Barroso and Montero-Ruiz 2017, 282).

While the examples of exchanged objects are, admittedly, few, examples of iconographic influence between the two areas are much more numerous. The concept of the horned warrior is widely distributed in the Mediterranean and beyond and goes back to c. 1200 BC (Harrison 2004, 59–65; Kristiansen and Larsson 2005, 246–50; Brandherm 2008; 2016; Vandkilde 2013, 170–75). Correspondences may be found especially between Sardinia and Scandinavia, when it comes to renderings of horned warriors (Vandkilde 2013, 173, figs 6–8). The similarities in minute detail seen in Nuragic sculptures/figurines and Nordic bronze figurines like those from Grævensvege in Denmark after c. 900 BC, are striking. This becomes especially clear when comparing the eye features of the Grævensvege figurines with those of the stone statues of Monte Prama (*e.g.* Araque González 2012, figs 4–5).

Numerous examples of bi-horned warriors are found in Spanish and Scandinavian rock art c. 1200–800 BC (Almagro Basch 1966; Harrison 2004; Díaz-Guardamino

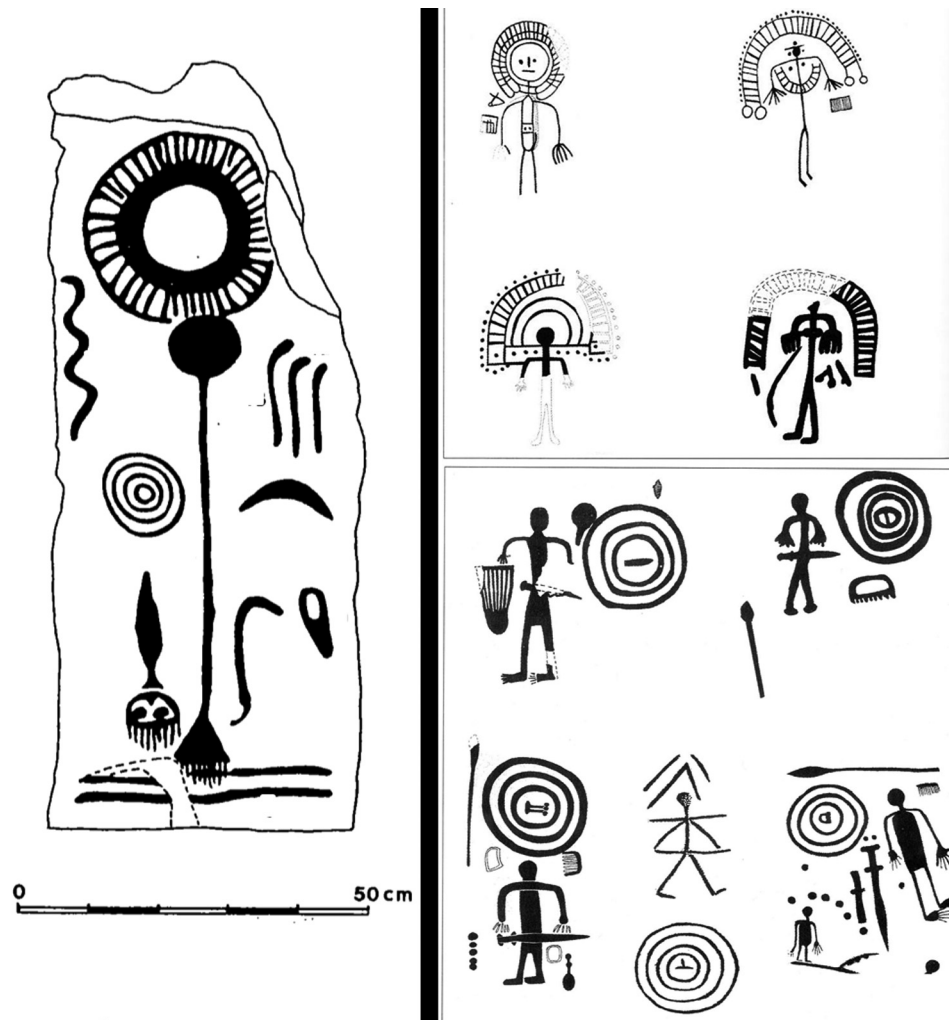


Figure 10.4 A stela from Norway compared to Iberian warrior stelae. Left: Kyrkje-Eide stela from Stryn, Sogn og Fjordane (modified from Mandt 1991, fig. 12.40). Right: Iberian stelae (from Harrison 2004, figs 10 and 14)

2010), and in Spain especially in the region of Extremadura (Figure 10.5). Obvious overlaps may be noted between these two areas in the rendering of horns, and even gestures and weapon representations. In general, the same categories of shields, daggers, bows, spears and swords are depicted in both regions, although not necessarily the same specific types. The greatest difference between Iberian and Scandinavian rock art is that the former portrays immobile images of warriors and weapons, whereas the latter depicts scenes with active warriors.

Despite being a periphery to the main European arteries of communication, even the more northerly parts of Scandinavia display evidence of contact with the Iberian Peninsula, as seen for instance in the odd Kyrkje-Eide stela from Sogn and Fjordane, Norway (Figure 10.4), dating to c. 1300 BC (Engedal 2010, 112–14, *cf.* Mandt 1991, 349). The stela has a particular Nordic imagery, suggesting that the European warrior concept was adapted to fit the cultural context, but has clear similarities with the imagery on

warrior stelae from the Mediterranean area dated to 1300–1200 BC, and especially those from the Iberian Peninsula (*cf.* Harrison 2004, 59–65; Díaz-Guardamino 2010; see, however, Celestino and López-Ruiz 2006; 2016).

Chariots were widely used during the Bronze Age in the Near East and eastern Mediterranean, and it is clear that they were employed in Iberia c. 1300–900 BC (Díaz-Guardamino 2010; Koch 2013, 111–13), and probably also in southern Scandinavia as well as in other regions of temperate Europe (Malmer 1992, 387; Johannsen 2010). There are strong similarities between war chariot depictions especially in Scandinavia and the Iberian Peninsula (Almagro Basch 1966; Harrison 2004, 146–50; Díaz-Guardamino 2010). On this basis, John Koch argued for a direct contact between the two areas (Koch 2013, 111–13). The indeed specific way of depicting the chariot bodies, draught poles and sometimes yokes and reins from above, whilst the wheels and draught horses are represented from a side view perspective, is likely to stem from first-hand knowledge of such ways of

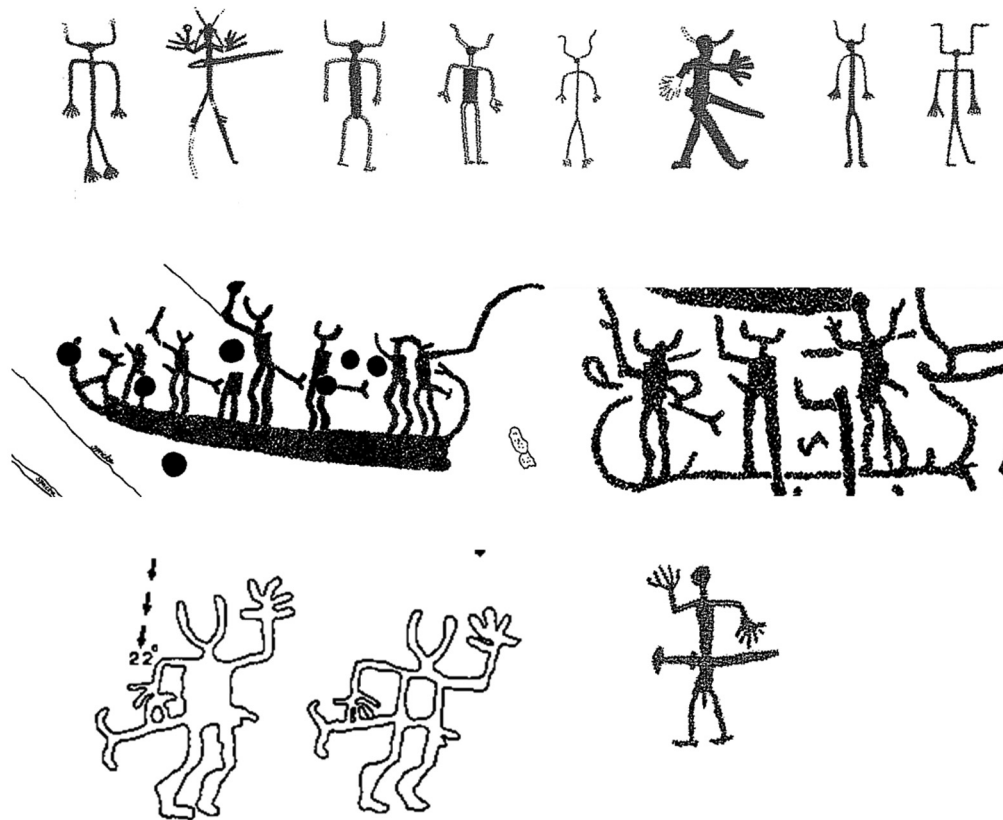


Figure 10.5 Rock art warrior depictions. Top row: warriors with horned helmets on Iberian stelae (from Harrison 2004, fig. 6.6). Middle: Scandinavian warriors with horned helmets (from Bengtsson 2009). Bottom left: two Scandinavian figures (source Swedish Rock Art Archives). Bottom right: Iberian figure from Baixo Alemtejo (from Harrison 2004, fig 6.6)

rendering a wagon, rather than a more generalized shared set of symbols and concepts (Figure 10.6/Colour Figure 10.6).

The perhaps most concrete evidence of interaction and contact between Scandinavia and the Western Mediterranean comes from the Isle of Thanet on the most easterly point of Kent on the British Isles. The site has been interpreted as an important Late Bronze Age and Early Iron Age trading place, evidenced by finds like bun ingots and Baltic amber. The most spectacular findings from the site are, however, the strontium and oxygen isotope data on human bone from Bronze Age burials. Besides a major group of local people from Kent, some of the analysed individuals show signatures consistent with a Scandinavian environment, while others have west Mediterranean signatures (McKinley *et al.* 2014, 167–69).

A key feature in understanding the Bronze Age Atlantic network system is the availability of tin, which was probably a main reason why groups from both the north and south directed their trade routes via the British Isles. Traders were in all likelihood not searching separately for tin and copper, and the opportunity to obtain both or supplementing Iberian copper with British tin accentuates the probability that locations on the British Isles and in Brittany acted as transit centers within the Atlantic network system. However, other

evidence discussed above, may suggest that this contact was of a more direct kind from c. 1300 BC.

Metal objects and amber are portable and may have changed hands a number of times before reaching their final destination, and cannot therefore be used to pinpoint the character of the contact. Although a transportation of slabs/stelae is possible, and a transportation of rock art motives in other (now lost) media is theoretically possible, rock art is in its nature less mobile and may therefore be a more reliable source to direct contact: close similarities in details are prone to result from direct human encounters.

Although the horned anthropomorphic representations may be considered to constitute a generalized representation of a pan-European warrior symbolism (Harrison 2004, 60), in our opinion, the striking overlap in minute details between bi-horned warriors in Spain/Sardinia and Scandinavia and their presence on rock art panels is more likely to rely on close and direct human interaction. A further indication that these shared cultural phenomena were related to the metal trade, is found in the fact that some of the areas in Spain with rock art similar to the Scandinavian, overlap with the areas where we find matching ore signatures, namely the Iberian Pyrite belt that cover a major part of southwest Spain and southeast Portugal. It is a fact, however, that the

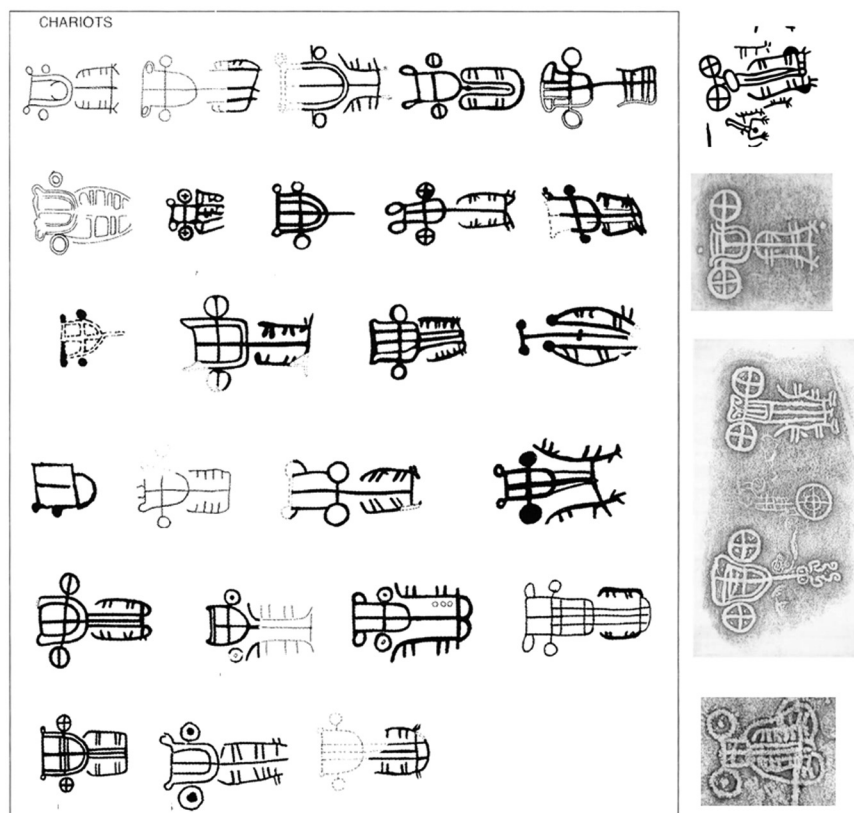


Figure 10.6 Iberian and Scandinavian depictions of chariots. Left: Iberian stelae (from Harrison 2004, fig. 7.16). Right: Swedish rock art (source Swedish Rock Art Archives)

mixing, or, pooling of ore from several ore districts occurred in the Mediterranean region (e.g. Knapp 2000), and in light of this we maintain that a direct correspondence between a particular mining district and cultural expressions in that particular area need not be a defining factor.

Conclusion

We have argued here from the point of departure of provenance studies of copper, that sea-based exchange networks were established during the second half of the 2nd millennium BC between Scandinavia and the Western Mediterranean. This was one among several trade networks, which provided the northerners with copper. For several centuries the connection was in-direct and likely to reflect impersonal exchange, until around 1300 BC the connection seems to have become more direct and more personalised. In our opinion, the morphological, stylistic and compositional correspondences between rock art panels in Sweden and Spain must rely on the movement of people between the two regions. The seasonal maritime trade in metal led to a common cultural ground and shared identities, values and codes that were expressed through rock art. Indeed, the British Isles must have played a prominent role in the Atlantic network that these trading expeditions evolved

from. It is striking, in this respect, that prior to the shift to, among others, Spanish ore sources, the British Isles were one of the providers of copper to Scandinavia. As indicated by the finds from Thanet, trade relations with the British Isles continued also in the later phase, and this is likely to have evolved around the acquisition of tin. While artefact finds speaking of long-distance exchange between Scandinavia and the Western Mediterranean are still few and to some degree disputed, the similarities in figurative art is, in our opinion, a clear indicator of direct contact between the two areas. These conclusions have been reached through a rereading of the archaeological evidence in light of new scientific data. The at first seemingly unlikely, or never-thought-of scenario of metal import to Scandinavia from the Mediterranean world has been forcing us to reconsider established truths, while at the same time insisting that these data are of little value if we are unable to reconcile them with valid archaeological theories.

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Chapter 11

Lead and copper mining in Priorat county (Tarragona, Spain): From cooperative exchange networks to colonial trade (2600–500 BC)

*Núria Rafel Fontanals, Ignacio Soriano, Xosé-Lois Armada,
Mark A. Hunt Ortiz and Ignacio Montero-Ruiz*

Introduction

Research into the role of mining and metallurgy in ancient societies has attracted considerable attention and has been approached from diverse interpretative perspectives. Some authors attribute an essential role to metal in the socioeconomic development of prehistoric communities and, more specifically, to its control by elites (see for example, Kristiansen 1987; Pare 2000; Vandkilde 2010). Others tend to relativise its importance in the creation and maintenance of power (Kuijpers 2012; Stöllner 2012). Along the same lines as other authors who have tackled this question (for a summary see O'Brien 2015, 290–98), we suggest that these perspectives are not mutually exclusive. Only a detailed study of each individual case can lead us to models based not only on prior theoretical positions, but also on interpretations that take into account both the theoretical frameworks and, above all, their particular empirical grounds.

A research programme begun in the year 2000 in the mining basins of Priorat county (Tarragona, Spain) is providing abundant data on prehistoric exploitations. These show a general scenario of their nature within the framework of the socioeconomic developments in the area during different temporal and cultural phases. This picture reveals very different situations depending on the phases, allowing us to suggest two very different management models for the area's metal-mineral resources. The evidence we present here shows how the economic appreciation of mining and its relationship with the ruling elites present very different panoramas, depending on the chronological and social contexts.

The mining basins studied

Although the northeast of the Iberian Peninsula is not an area with major metal-mineral resources, Priorat county, our

study area, has a relatively high concentration of them. They are spread across the whole county and, for the purposes of this study, we have divided them into two basins: Montsant and Molar-Bellmunt-Falset (hereinafter MBF) (Figure 11.1).

Priorat county is in the Catalan Pre-Coastal Range and acts as a hinge between the Ebro, the flat lands of the Tarragona coast and southern part of the province of Lleida. The morphostructural unit of the Catalànids (made up of the Pre-Coastal and Coastal Mountains) formed during the Palaeozoic and Mesozoic eras. The Palaeozoic basement is from the Carboniferous period with a granitic intrusion that creates a small contact metamorphic aureole which has been revealed by the erosion of the Mesozoic cover. The county's mineral veins are found in this Palaeozoic basement.

The point where the Catalan Pre-Coastal Range divides into two marks the northern edge of the Montsant mining basin. This basin extends southwards and the greatest concentration of metal-mineral resources is in the Cornudella-Ulldemolins ridge, which originates from the aforementioned separation of the Catalan Pre-Coastal Range. This is also where the Palaeozoic basement outcrops and where the veins, mainly in slate and sandstone, are found. Of the mineralisations recorded in this basin of the Montsant (IGME 1974; Mata 1990), the most important formations are filonian. Outstanding among them are those of lead (Pb) at Cornudella de Montsant and copper (Cu) (mainly as sulphur-bearing minerals) at Cornudella-Alforja. The latter are very extensive and their exploitation is documented in the historical period; they cover the municipal areas of Arbolí and Riudecols, as well as the previously mentioned municipalities of Cornudella and Alforja. They are characterised by mineralisations in veins hosted in the carboniferous slates and here we find the Els Crossos copper mine to which a prehistoric origin (as yet unconfirmed) has been attributed. We also recently discovered La Turquesa

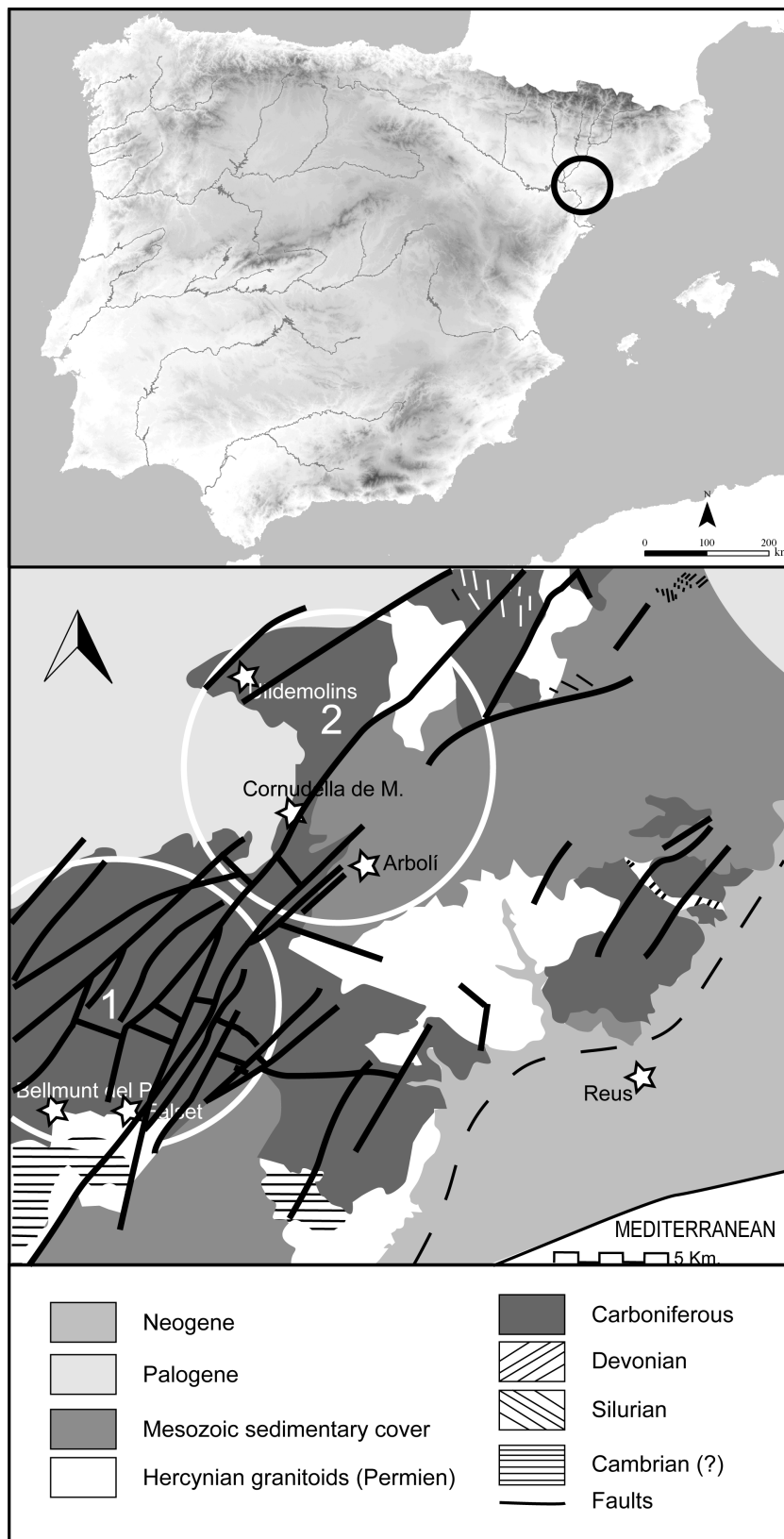


Figure 11.1 The location of Priorat county in the northeastern Iberian Peninsula and a geological map of the study area showing the two main mining basins: 1. MBF; 2. Montsant

or Mas de les Moreres mine here (Soriano *et al.* 2017). In the first area, Cornudella de Montsant, the brecciated veins, also hosted in carboniferous slates, offer the most common minerals of galena, calcite and quartz. This is where we find the Barranc Fondo Mine (Pb-Zn), in which copper (Cu-Fe) is also documented. Mineralisations of volcanic origin are documented in Ulldemolins and the neighbouring municipality of Vilanova de Prades. They consist mainly of galena, chalcopryite and sphalerite, with other minority minerals, among which grey copper is of particular note; mineral alterations such as malachite and the azurite are also documented. The prehistoric mine of La Solana del Bepo and the mines of El Bessó and El Barranc de Sant Joan are located in this area as well.

The Baix Priorat or MBF mining basin is best known for its abundance of lead, which was mined up until the 1970s. The basin also has copper and silver resources, although these are less abundant. The galena has very low concentrations of silver and has historically usually been most appreciated for the purity of its lead. Hosted in the Palaeozoic rocks (slates) are the mineralised veins; they are mainly of lead, but there is also some silver, copper and zinc (Canals and Cardellach 1997). The most important mines of this type are, from west to east, Linda Mariquita, Raimunda, Jalapa, San José Norte and Regia. Aside from their exploitation in prehistory, to which we will refer below, their historical importance has been well documented from the mediaeval Christian era to the 20th century and it is more than likely that they were worked in the Andalusi and Roman eras. For the latter period, we have proposed identifying it with Pliny's *plumbum nigrum oleastrense* (*Naturalis Historia* XXXIV, 49, 164) (Rafel and Armada 2010). Native silver and silver minerals (argentite, chlorargyrite) have been documented (Mata 1990, 128–150; Rafel *et al.* 2003; Abella 2008); they were also extensively mined in the Middle Ages (14th century) by the Count of Prades (Rafel *et al.* 2003; Martínez i Elcacho 2014).

The exploitation model in the Late Chalcolithic/Bell-Beaker Period (2600–2300 cal BC) and the Early and Middle Bronze Ages (2300–1300 cal BC)

From the Late Chalcolithic through the Middle Bronze Age, both the population and the mining were concentrated in the Montsant basin. The earliest exploitations we have been able to document correspond to the period between the Late Chalcolithic (Bell Beaker period) and the Middle Bronze Age. At that time, copper minerals were being extracted at La Turquesa (or Mas de les Moreres) mine; its excavation revealed the mined vein, as well as a small shaft and the remains of other starts. All are modified by

more recent industrial workings (Figure 11.2). This mine also provided an abundant collection of stone mining tools and natural supports for their manufacture (127 items). Most of them are artefacts made with igneous, metamorphic and sedimentary rocks and have a low degree of standardisation and a high degree of use. Only 8% of the items have T-shaped hafts (Soriano *et al.* 2017). As far as their dating is concerned, so far we only have indirect data from lead isotope analyses. A copper awl dated to the Late Chalcolithic–Early Bronze Age and found in the neighbouring L'Heura Cave (Ulldemolins) presents an isotopic signature compatible with that of La Turquesa Mine. Likewise, a reduction vessel from El Buldó Cave and another from Cau del Duc (Montblanc), datable to the Early–Middle Bronze Age, also present an isotopic identification with the same mine (Rafel *et al.* 2017).

A large number of stone mining picks from La Solana del Bepo copper mine have been studied since the 1940s (Vilaseca and Vilaseca 1957; Rafel *et al.* 2016; 2017). Recent excavations (still unpublished) have given us stone utensils for which radiocarbon dating indicates the mine was exploited during the Middle Bronze Age, although we cannot rule out that the site was worked prior to that time. The total assemblage of mining tools now stands at 106, most of which are picks (Figure 11.3). Their manufacture, of local hornfels and granite, involved a high degree of transformation; they were also well-used. The vast majority of the items that preserve their proximal end have a T-shaped hafting device. The lead isotope analysis data, although still preliminary due to the small number of samples analysed, suggest a link between this mine and a riveted dagger found at Cova de la Font Major (L'Espluga del Francolí) (Rafel *et al.* 2017). This dagger has been dated typologically to the beginning of the Middle Bronze Age, coinciding with the radiocarbon dates from the mining. Although, unlike those two mines (Turquesa and Solana del Bepo), we do not have any direct evidence of working, it is possible that El Barranc Fondo mine was also exploited at that time. This is suggested by the correspondence detected in the lead isotope analyses between values for the mine and archaeological metal items dated to those periods (Rafel *et al.* 2017).

Although, as we have already mentioned, the prehistoric mine workings are mainly identified in the Montsant copper veins, we have also documented a Palmela point from El Tossal de les Benes (Rojals) and a lead necklace bead from L'Heura Cave, whose isotopic signatures correspond to the Linda Mariquita mine in the MBF basin. The bead, the only lead bead known to date in the whole of the Iberian Peninsula, corresponds to a type that can be clearly linked to the south of France. These pieces, which are very abundant in that area, are associated above all with Chalcolithic horizons (from Fontbouïsse, but also present in the Ferrières



Figure 11.2 Aerial view of La Turquesa Mine after the excavation had been completed (2015). The arrow indicates the pre-industrial workings

facies), although with continuations into the Early Bronze Age (Rafel *et al.* 2016).

The vast majority of the archaeological sites from this period (Figure 11.4) are known from early excavations carried out in limited methodological conditions. Schematic-abstract style rock art is represented by seventeen archaeological sites that are mainly concentrated in the municipality of Cornudella. They are difficult to date, although we can place them in a chronological range between the Neolithic and the Bronze Age. In consonance with the abundance of evaporitic flint in the county, we have documented 15 archaeological sites of the so-called ‘flint workshop’ type, *i.e.* open air areas where there are no signs of habitat, but abundant remains of knapping and flint utensils that attest the nature of the activities. They are in the Prades Mountains and the Montsant Massif, as well as in the far southeast of the county. Habitat is represented by fourteen archaeological sites, of which eight are in caves and the rest in the open air. Eight burial caves reveal funerary customs based on collective burials. Only in the Late Chalcolithic do we detect – synchronous with use of collective tombs – individual funerary rituals associated with Bell-Beaker materials (Palmela points, tanged daggers, pyramidal buttons with v-shaped perforations). This funerary duality

with two completely contrasting traditions (collective vs individual) is a constant feature during the Late Chalcolithic in the northeastern Iberian Peninsula.

The reassessment of these archaeological sites shows a scenario of communities linked to the territory, but with a certain mobility within their catchment area. They were organised into small groups who lived in caves, rock shelters and open air habitats and they buried their dead collectively, and in some cases individually, in natural caves or paradolmens. The basis of their economy was agricultural and obtaining raw materials was a part-time activity undertaken on a limited scale. They exploited the copper-bearing resources of the Montsant Basin, the rich and abundant veins of flint and, possibly at certain times, the lead and copper of the MBF Basin. Finds of flint from Priorat county at archaeological sites in the province of Lleida (Palomo *et al.* 2012; Esteve *et al.* 2015) tell us of the existence of trade routes, although of limited scope. The current data we have on copper minerals from the Montsant area suggest they were distributed within a radius of about 50 km (Figure 11.5) and that there were also exchange networks between nearby communities. Although no open-air habitat has been excavated to date in the county, the survey data indicate a population structured in villages



Figure 11.3 Picks with a T-shaped haft from La Solana del Bepo mine. 2016 excavation campaign

with simple constructions of perishable materials and little stability, as was the norm in the whole north-east at that time (Rafel *et al.* 2008).

The irruption of colonial trade and the new exploitation model of the 8th–6th centuries BC

The Late Bronze Age in the northern Priorat – the location of the Montsant mining basin – saw a phase of decline, above all in its final period. This appears to have been caused by the concentration of the population farther south. Although there is no lack of settlement evidence, there appears to have been a notable reduction in population in comparison to the prior Late Chalcolithic–Middle Bronze Age phase.

At the same time, we see a significant reorganisation of the territory in the southern Priorat. This would undoubtedly have been accompanied by other important changes in the social structure of the communities. The concentrated population, the emergence of stable proto-urban settlements with buildings constructed with stone socles, urnfield-type cremation burial sites, material finds related to the western urnfields, and a concentration of the population around the MBF basin all point to significant structural changes.

Nevertheless, the material culture also shows clear signs of cultural continuity from the prior period.

In summary, the population became more fixed in the territory; there was a consolidation of sedentary lifeways, an abandonment of cave-dwelling, a significant concentration of the population in a few settlements, a significant intensification of contacts and a displacement of the centre of interest from the north to the south. The southern territory of the county and the MBF mining basin constitute a landscape of hills that are lower and less fractured than those to the north and offer better possibilities for agricultural use. Above all, they have easy access to the major communications artery of the time, the Ebro river, which is only 4 km from the main settlement in the southern Priorat, Calvari (El Molar). These are settlements – the most important being the aforementioned Calvari and El Puig Roig (Masroig) – whose locations were determined, firstly, by the proximity of the metal-mineral sites (Cu, Pb) and, secondly, by ease of access to the previously-mentioned main communications route in southern Catalonia, the Ebro River. These changes occurred at a time when inter-regional relations and long-distance trade were expanding.

During the Late Bronze Age, we see the first timid signs of inequality. Nevertheless, the nuclear family appears to have

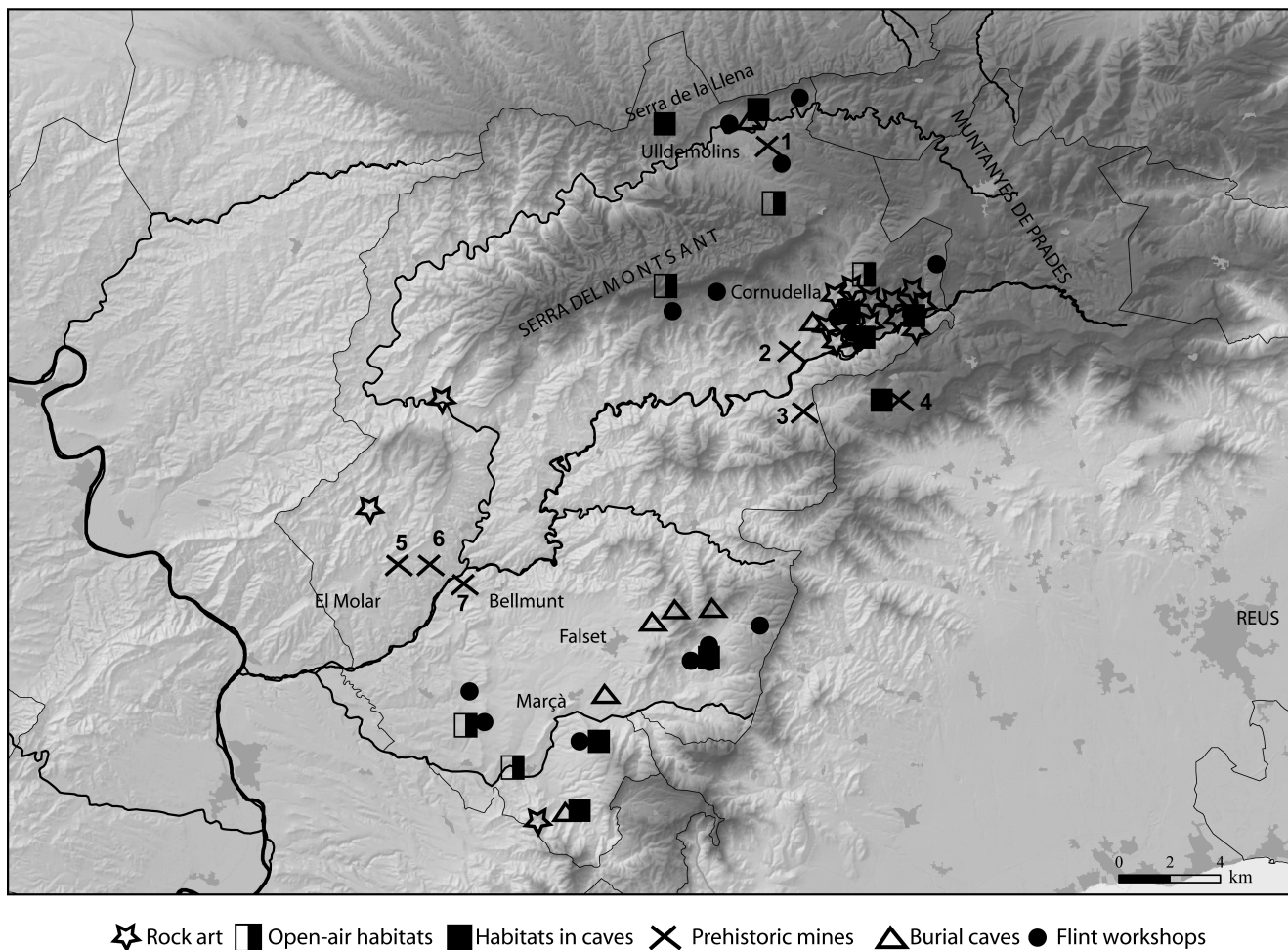


Figure 11.4 Late Chalcolithic and Early and Middle Bronze Age archaeological sites. Mines: 1. Solana del Bepo; 2. Turquesa; 3. Barranc Fondo; 4. Els Crossos; 5. Linda Mariquita; 6. Jalapa; 7. Barranco Hondo

been the basic unit of exploitation in a general economic framework that did not produce surpluses. Chronologically, the new population structure had its roots in the 9th century, although its full formalisation took place in the 8th century, and its moment of *flourit* in the 7th century and the first half of the 6th century BC. The society of this time shows signs of incipient hierarchisation, thus demonstrating the evolution of the egalitarian Bronze Age communities towards more ranked, unequal formations that anticipated the emergence of the Iberian aristocracies (Rafel and Armada 2009; Armada *et al.* 2013). We have to look for the beginning of this process in the evolution of the local communities themselves, although the irruption of Phoenician trade in the northeast provided a crucial impetus. The Phoenician presence was consolidated in the south of the Iberian Peninsula and on the island of Ibiza from the 8th century BC, along with their southern trade networks. From that point, the Phoenician trade network spread along the Mediterranean façade, where it was particularly active on the lower reaches of the Ebro (Garcia i Rubert and Gracia Alonso 2010). This expansion

was not conducted as a search for specific materials, but rather to extend their markets. Due to its proximity to the river, the southern Priorat was involved in that trade, as attested by the finds of Phoenician amphoras.

The intensive archaeological and archaeometric study programmes undertaken in the MBF mining basin have demonstrated that, although it is quite possible that in the 10th–9th centuries the inhabitants mined the local copper, from the 8th century, and especially during the 7th and 6th centuries BC, they received copper from the southeast of the Peninsula and above all from the Linares mining basin (Jaén) (Montero-Ruiz *et al.* 2012). The analytical data we have so far, which constitutes quite a large empirical base, reveals that all the bronze objects were manufactured with exogenous copper. In contrast, the mining activity of the MBF basin populations at that time focused mainly, if not exclusively, on local galena, the main sources of which were nearby the settlements of El Molar and El Puig Roig. In relation to this last aspect, it is necessary to note that this was a time when lead was a metal barely used by the local

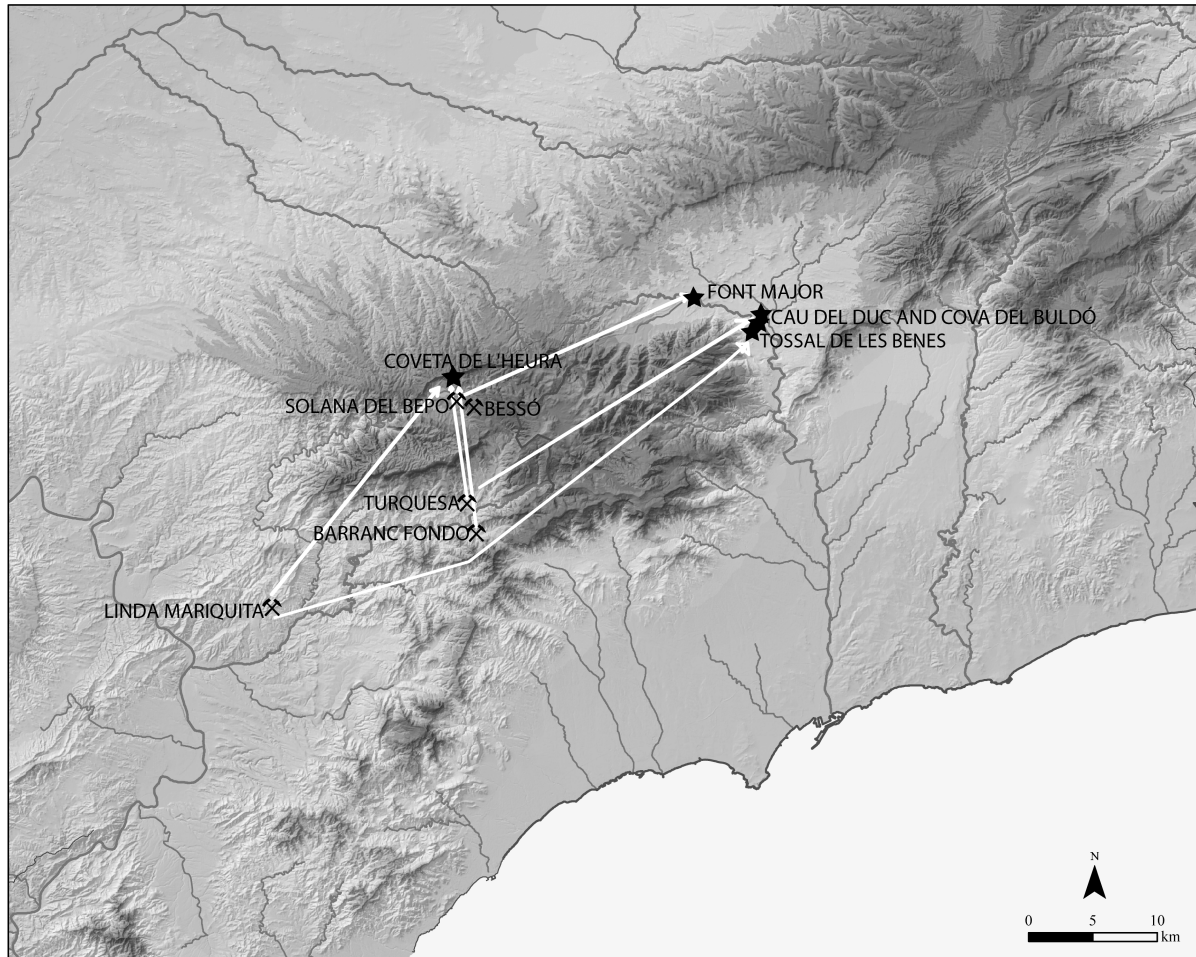


Figure 11.5 Mines in the Montsant and MBF basins with exploitation data from the Late Chalcolithic and Early and Middle Bronze Age and metallic objects or those linked to metallurgy with a specific assigned provenance determined by lead isotope analysis

communities and it would not be more widely used until the Iberian period. The lead isotope analyses (Figure 11.6/ Colour Figure 11.6) have allowed us to conclude that the galena mined in that period in the MBF basin was sent to the south of the Iberian Peninsula, where it has been documented at various Tartessian archaeological sites (Murillo-Barroso *et al.* 2016). At that time, intensive silver mining is documented in the Tartessian area. The silver was obtained mainly from jarositic minerals with large percentages of silver, but no lead. To attract the silver during the cupellation process they had to add lead obtained from other mining basins (Hunt 2005), including the MBF basin (Figure 11.7). Galena mining in this northeastern basin was, therefore, clearly for trading purposes and not for local consumption. The archaeological evidence from the county's settlements shows that the galena mining was structured and managed by the local populations. These were organised around two main settlements, Calvari del Molar and El Puig Roig del Masroig. However, the evidence also clearly indicates that this activity was an initiative fostered

by trading intermediaries in contact with the Phoenicians and their associated demand for lead (Rafel 2012). Thus, during the indicated period, the people living in the southern Priorat completely or almost completely abandoned copper mining to concentrate on the exploitation of galena to place on the Phoenician-fostered trade networks. In return, they had access to the products – mainly wine and other goods (*e.g.* decorated fabrics) – that reached the coasts of the north-east via those networks. For the local peoples these were exotic, prestige goods that contributed to an intensification of the processes leading to inequality.

Intensive lead mining continued in the MBF basin until the 1970s. This profoundly transformed the landscape of the archaeological mining sites, meaning that, unlike in the northern Priorat, we have as yet been unable to document directly any prehistoric workings. The mines of this basin have been analysed using an indirect methodology based essentially on lead isotope analyses (Montero-Ruiz *et al.* 2010). As a consequence, we do not have any direct data on the material and socioeconomic conditions of the mines.

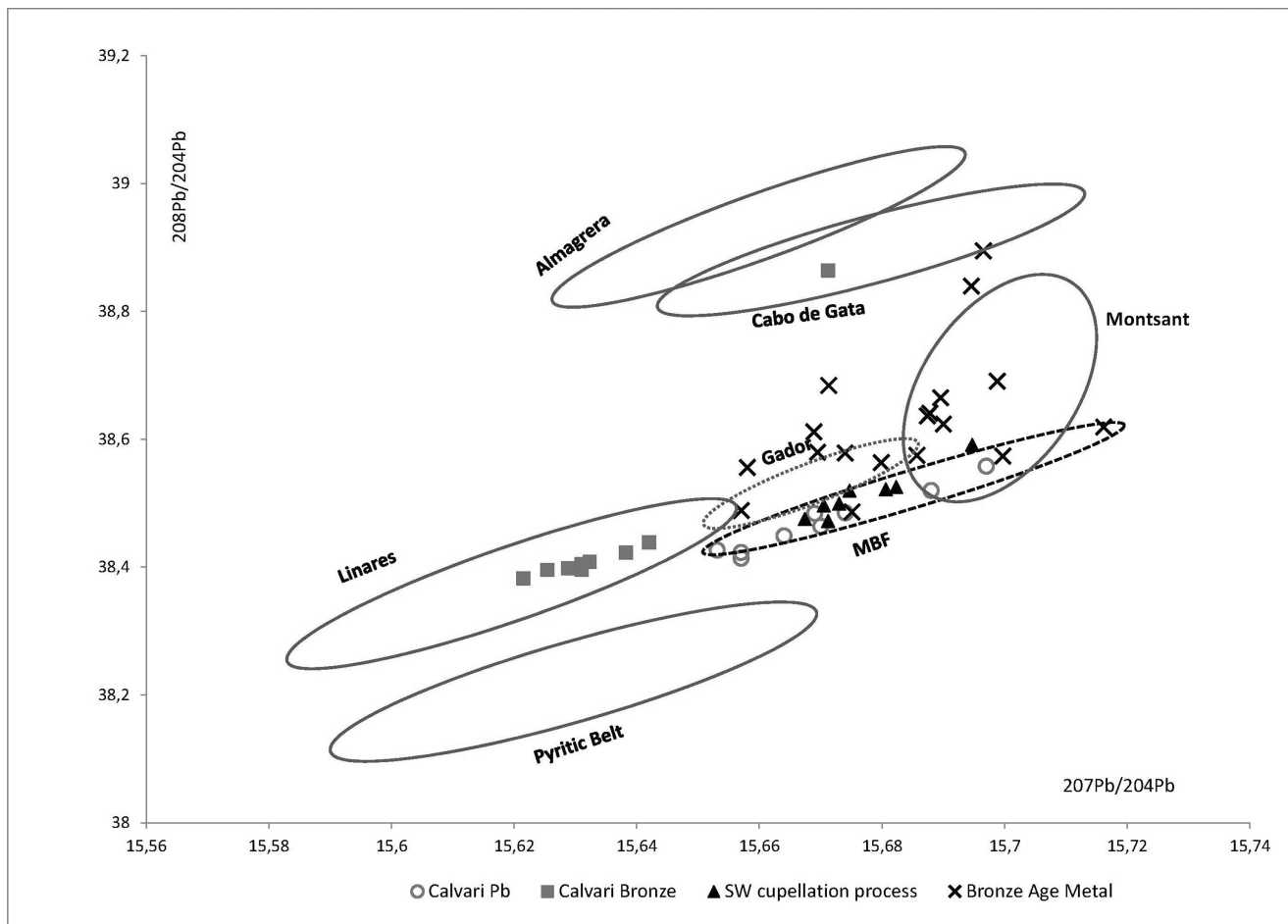


Figure 11.6 Bronze items from the settlement of El Calvari (First Iron Age), items from the Priorat datable to the Late Chalcolithic and the Early and Middle Bronze Age and cupellation remains from the south-west of the Iberian Peninsula in relation to the isotopic fields of Sierra Almagera, Cabo de Gata, Linares, Gador, Montsant, MBF and the Faja Pirítica

However, the indirect evidence coming from the habitats points to a greater specialisation and probably control over production by elites or incipient personal powers. In the settlement of Calvari there appears to have been an area devoted to metallurgical production, as well as a singular building of almost 100 m². This contrasts with the usual houses at the site that are smaller, have a single room and no indication of hierarchical differentiation. This picture is observed in the whole northeastern Iberian Peninsula in earlier and contemporary chronological horizons.

In around 550, coinciding with major geopolitical changes in the whole of the western Mediterranean, a crisis struck the Phoenician mercantile structure on the Iberian Peninsula (Aubert 2009, 344–48) and Phoenician trade with the lower Ebro Valley collapsed. At the same time, the settlements in the southern Priorat were abandoned in what appears to have been a general crisis in northeastern Iberia. There was a population vacuum until, much later, in the 3rd century BC, a new territorial organisation emerged led by the nearby Iberian town of Castellet de Banyoles

(Tivissa). It is at this time that we document a small partial reoccupation of Calvari on the ruins of the earlier habitat, possibly an outpost used by Castellet de Banyoles to supervise and control mining, which now came under that town's jurisdiction. Nevertheless, during those centuries of population vacuum, galena from the Priorat is found in the Greco-Phocaean colony of Emporion (L'Escal, Girona), a fact that we interpret as evidence of direct control of the exploitation by the Greek colony itself. It must be pointed out that at this stage the galena from the Priorat is only documented in Emporion and its hinterland (Rafel 2012).

By way of conclusion: metal and power in the Priorat

Late Chalcolithic (2600–2300 cal BC) and Early and Middle Bronze Age (2300–1300 cal BC)

The amount of metal circulating in those long periods was not very high, but it was of major social significance. The number of metal items documented in the territory reveals

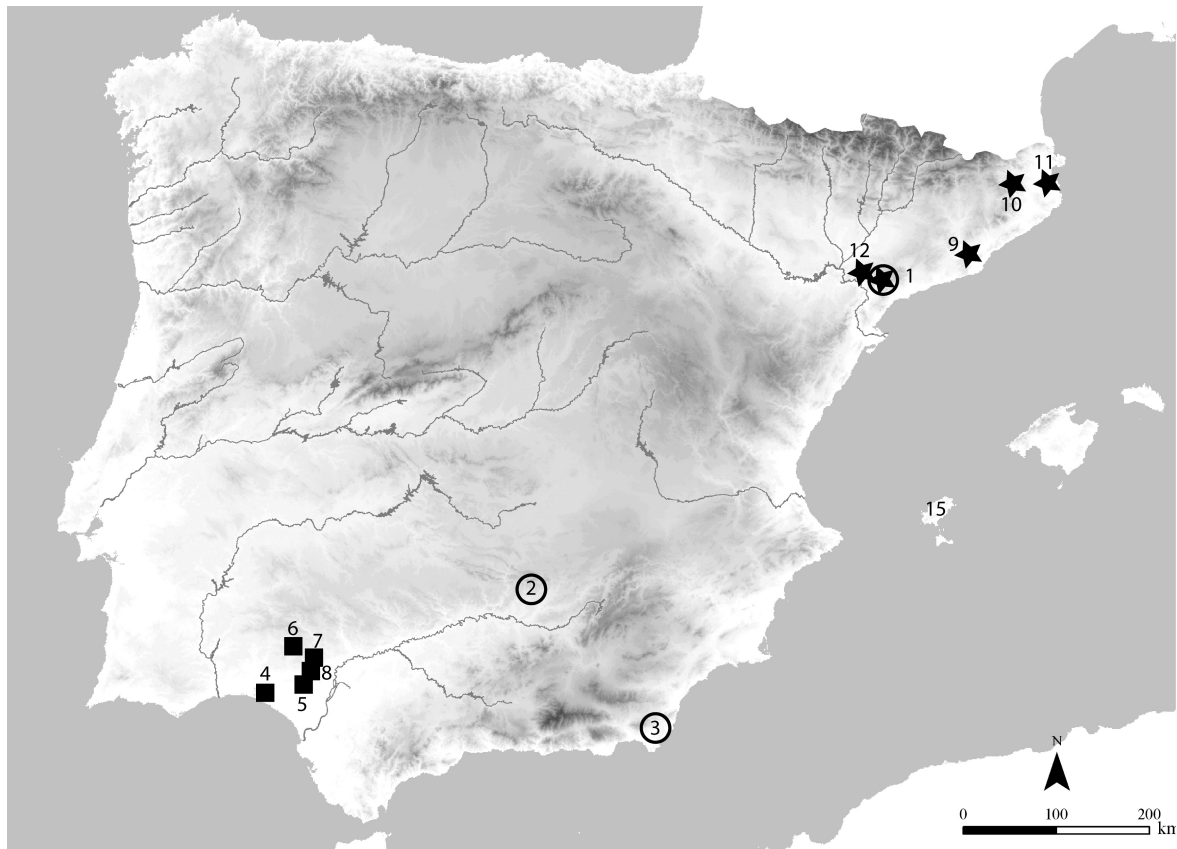


Figure 11.7 The distribution of copper from Linares and the south-east and of lead from the Priorat (MBF). Mining basins (circles): 1. Priorat; 2. Linares; 3. SE (esp. Gádor and Cartagena). Lead from the Priorat in Western Andalusia (squares): 4. Calle del Puerto (Huelva); 5. Tejada la Vieja (Escacena del Campo, Huelva); 6. Cerro de las Tres Águilas (Minas de Riotinto, Huelva); 7. Cortijo José Fernández (Castillo de las Guardas, Seville); 8. Torre del Viento (Aznalcóllar, Seville). Copper from Linares in archaeological sites of the north-east (stars): 1. Calvari (El Molar, Tarragona); 9. Can Roqueta (Sabadell, Barcelona); 10. Vilanera (L'Escala, Girona); 11. Can Xac (Argelaguer, Girona), 12. Sebes (Flix, Tarragona)

a metallurgy with a limited economic weight and the characteristic technology of the Iberian Peninsula based on reduction vessels (Rovira and Montero-Ruiz 2013). Metal was of little importance in productive life, in which most of the tools used were still made of stone. As we have already said, the pattern of consumption was local and minerals were only distributed over a small area, probably in exchange for flint. The dispersion of local raw materials shows a pattern of trade based in inter-group cooperation and direct contacts. In short, although in this period the social function of metal became an important aspect of group identity, its economic importance was limited.

Based on the contextual data at our disposal, to which we have referred briefly, mining appears to have been organised on the basis of groups of part-time miners. These miners formed part of the economic workforce in the group's agricultural-based economy, in other words, they would have been farmworker-miners. However, they probably had a specific status, as not all members of the community would have participated directly in the mining, but rather

only those who were strong and/or agile enough and had the necessary empirical knowledge and skills. The mineral processing tasks were no doubt also subject to similar conditions. However, in neither case did this situation lead to the formalisation of personal powers. As has been proposed for other contexts based on different types of evidence (Rowlands 1976; Ottaway 2001), miners would not have been a differentiated group, but part of general society. Nevertheless, given the archaeological invisibility of the mine agents, we cannot go beyond inferring hypotheses regarding their status based on indirect data.

In summary, we lean towards considering the data available to us as symptomatic of a cooperative maximisation of resources and a distribution confined to local and immediately adjoining territories, though not the product of communities of specialist miners. None of the archaeological data we have justify a hierarchical structure organised around these activities; rather they seem to suggest a panorama of small-scale communities, self-organised into networks, probably with informal and specific powers that

formed an intrinsic part of the network and cooperated in its collective organisation, although without any development of institutionalised powers.

First Iron Age (800–500 BC)

We currently have no data on mining in the Late Bronze Age, except for the find of local copper oxide in a settlement in the southern Priorat, dated to the 10th–9th centuries (Armada *et al.* 2013). As we have seen, we have a solid empirical base for the First Iron Age. In one hand the nuclear area was now situated in the MBF basin. On the other hand social framework is completely different from the earlier developments linked to the Montsant basin.

This period is characterised by an organised population structure in the southern Priorat that controlled the MBF mining basin and was centred on two proto-urban habitats, Puig Roig and Calvari, the latter of which appears to have been the focal point from a hierarchical perspective. Other smaller settlements were dependent on them, with the whole forming a social territory. Metal use, now bronze, is seen to be consolidated, although some stone tool making continued. Mining became more intensive, but continued to be carried out on a part-time basis. This was the norm in European prehistory, except in some large mining areas such as Mitterberg (O'Brien 2015, 248). Nevertheless, in contrast to the earlier period, mining and metallurgy now played an economic role, in addition to a social one. They became an important part of the territory's economy, although that continued to be based on agriculture. The concentration of the population and the appearance of signs of differentiation in the architecture of the settlement of Calvari combine to indicate the probable development of an incipient system of hierarchisation in the organisation of mining as well as the trade in minerals and metals that were generated.

This is a process that was rooted in the preceding developments, as attested by the fact that the stable settlement with stone buildings began to appear at the end of the Late Bronze Age (10th–9th centuries). There was also a basic continuity in some of the movable artefact traditions associated with the same horizon. However, the developments of the First Iron Age also received an undoubted stimulus from the Phoenician trading presence. The Phoenicians were already well established in southern Iberia when the trade linked to them expanded towards the north-east. Their colonial hinterland encompassed the main mining resources of the Iberian Peninsula, including lead, which was particularly abundant in the southeast and the Linares mining basin (Jaén province). The fact that lead minerals flowed from the Priorat to southern Iberia attests the opportunistic nature of that trade, which arose from a search for new markets of interest to those southern societies. Whatever the case may be, the colonial phenomenon led the local population to give more weight

to mining, emphasising from that time the exploitation of galena for the market created by the new trade networks. Minerals and metals now moved over great distances, no longer forming part of a reciprocal system of exchange, but of a true market-based trading network, at least as far as the Phoenicians were concerned. Without doubt, this also resulted in the increased economic role of mining and its consequent conversion into an activity subject to a certain control by nascent formal powers. These new elites had an interest in mineral and metallurgical production as a way of obtaining goods and establishing contacts that would, in the long run, consolidate their status.

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Part 4

Concluding remarks

Chapter 12

Mobility, minds and metals: The end of archaeological science?

Marcos Martín-Torres

Archaeology and the sciences have a long history of mutual engagement, with notable cases of great success and as well as frustrating, perhaps avoidable, failure (for overviews, see Killick and Young 1997; Kristiansen 2014; Killick 2015; Martín-Torres and Killick 2015). Over a century has passed since the first documented collaborations between scientists and archaeologists, and at least five decades since the first published debates about the significance, or indeed the pertinence, of such collaborations (Hawkes 1968; Isaac 1971; see also Olin 1982). The fact that we continue to write with incessant frequency about this interdisciplinary interaction (*e.g.* Lidén and Eriksson 2013 and replies; Sørensen 2017 and replies; Ion 2017), may be taken as a strong indication that that we continue to disagree in many respects, and that things still leave plenty of scope for improvement. Very few would deny today that archaeology, like any other discipline, only realises its full potential when empowered by science. At the same time, however, some archaeologists lament or resist the perceived intrusion of science (or scientists), which has evolved from a subservient producer of data to a leading role in posing questions, setting agendas and attracting research funding, hence shaping the discipline in previously unforeseeable ways that potentially sideline human agency, the symbolic realm, or anything that defies measurement or generalisation. Many scholars continue to dissect this interaction, seeking to understand the challenges and, frequently, proposing ways forward. Among these, some have once again referred to the Two Cultures debate in an attempt to chart what they perceive as a challenging divide between archaeologists and scientists (*e.g.* Smith 2017; Sørensen 2017). In this, they echo a discussion that was as fruitful as beguiling when this debate took place in the Cambridge of the 1950s (Snow 1959), but which some of us find of little relevance

today (Martín-Torres and Killick 2015, and see below). Quite remarkably, a relatively recent review paper on the future of archaeological theory omitted any overt mention of the natural sciences (Thomas 2015), perhaps implying that scientists have little to contribute to theorisation about the human past.

Archaeometallurgy is one of such interdisciplinary intersections, with a history that goes back to the 18th century (Pollard 2013). As such, reading a book on archaeometallurgy that promises in its subtitle to integrate ‘scientific data and archaeological theory’, I could not but be prompted to reflect on what this publication says about the state of the discipline, and about its future. Taking up the kind invitation of the editors, the next few pages present a highly personal series of highlights, views and thoughts inspired by the chapters in this volume. Rather than attempting to summarise each contribution in detail, I try to situate the book in a broader context and offer some reflections about the future of archaeometallurgy and archaeological science more generally.

Mobility

I must admit to some initial unease with the term ‘mobility’, recurrently used in archaeological literature and enshrined in the title of the book. By becoming a catchphrase that encapsulates and justifies some of the best and the worst of current research, the word is at risk of losing any significance. Just as migrations were the bread and butter of archaeological interpretation 100 years ago, the growing availability of methods that allow us to provenance things and beings to their geological source has, in the last five decades, led to an exponential spur of studies that sometimes seem to correlate their success with the distance

travelled by the samples studied. A simple Scopus search for ‘archaeology’+‘mobility’ yields a yearly average of 50 papers for the last five years, compared to just five papers at the beginning of this century.

Of course, tracing the movement of people, ideas, materials and things provides a fertile and well-justified approach to the past, and since we have the methods to investigate this important arena of human behaviour there is no reason, in principle, why we should not do so. Indeed, there is no denying that, overall, mobility studies have shown that prehistoric people, animals and things moved further, and more frequently, than we might have suspected, and this is compelling us to rethink our archaeological narratives. At the same time, rather blunt rebuttals to overly optimistic, sometimes arrogant, occasionally naïve archaeogenetic studies of prehistoric migrations serve as a reminder that one should not try to re-write the past while disregarding archaeology, archaeologists, and their long-developed bodies of knowledge (Kershaw and Røyrvik 2016; Vander Linden 2016; Heyd 2017; Ion 2017).

Refreshingly, *Metals, minds and mobility* is an anthology of good practice. The list of contributors to this volume comprises prominent scholars at various career stages, whose educational backgrounds straddle from archaeology and anthropology to chemistry and metallurgy. Irrespective of their academic degrees, a good number of them – notably, including all three editors – would comfortably fit in the loose category of ‘archaeological scientists’, working as profitably in the laboratory as in the library, the field or the museum, and resolutely taking advantage of the tools of science to advance their study of the past. As such, as I first browsed through the pages of this book, I was struck by the conspicuous scarcity of the charts and data tables that frequently fill the pages of their publications. Was there no science in this book, then? No data? Quite the opposite: this book would not exist without science, and the vivid archaeological narratives, enthusiastic arguments and research agendas presented here would not be conceivable without the rich datasets that, in turn, both bolster and challenge theories.

In this book, metals are certainly seen to move, but they are not reduced to dots and arrows on maps. Instead, at different analytical scales, we variously see miners, makers, merchants and consumers, different social groups and economic structures that overlap and interact through the media of metals and other materials. It is the nature, scale and social impact of this movement that the authors strive to explain. In this sense, some of the most interesting discussion points tackled in the book pertain to the understanding of exchange and its social consequences, with the majority of the contributions focusing on noble and non-ferrous metals in prehistoric Europe, the Mediterranean and the Near East.

Kienlin (this volume), for example, presents a demolishing critique of World Systems Theory and how it has, in his

view, been simplistically exploited to explain the evidence for the exchange of metals between the Mediterranean and northern Europe in the Bronze Age. According to him, there is no reason to assume that exchange is always asymmetrical and, crucially, some researchers should be reminded that materials may undergo dramatic changes in value when recontextualised, and hence identical objects occurring in different regions cannot be taken as indicative of equivalent social structures.

Some of Kienlin’s strongest criticism is directed at the work of a Scandinavian team, first epitomised in Kristiansen and Larsson’s (2005) volume. Since the publication of this book, researchers have continued to generate relevant results and discussion that are increasingly nuanced and data-rich, some of which appear in the current volume. In their contribution, Melheim and colleagues return to the hot topic of the trade of metals from southern Europe to Scandinavia, and they propose some clear (and surely contentious) claim: the existence of direct seaborne trade between Iberia and Scandinavia in the Late Bronze Age, operated by Nordic trader-raiders, and leading to ‘a common cultural ground and shared identity, values and codes that were expressed through rock art’ (Melheim *et al.* this volume).

In broad terms, both papers are discussing the same body of evidence, and one that keeps growing in size and complexity as a result of scientific analysis (see Radičević *et al.* 2018 for an extensive overview of this debate and its implications). Their differences derive largely from their theoretical stances, the variable significance given to the impact of the exotic materials in new environments, and the social relationships that result thereof. Rowlands’s contribution (this volume), resuscitating the work of French Marxist anthropologists, may provide some middle ground to reconcile the above perspectives: drawing on examples of exchange between capitalist and non-capitalist societies, he explains how different social systems can participate in exchange while retaining their cultural and economic idiosyncrasy. Also enlightening for this debate is Killick’s (2009) critical appraisal of many archaeologists’ use of World Systems Theory, showing the risks of oversimplification but also the informative potential of nuanced approaches that consider the transfer of goods but also that of knowledge.

Minds

Notwithstanding the methodological challenges of tracing metals to source and the ensuing difficulties in explaining the channels and modes of exchange, arguably an even more elusive subject is that of knowledge transmission. Research on the inception and spread of metallurgical knowledge, and discussion of its social impact, are integral to archaeology since the work of Gordon Childe (1930). While dating and mapping the earliest instances of metal use still remains a useful approach to the question (Renfrew 1973; Roberts

et al. 2009), researchers are increasingly exploring this subject through the comparison of technical sequences. As vividly outlined by Bray (this volume), analytical techniques allow us to reverse engineer individual artefacts or assemblages, characterising technical steps and rich object biographies with very high degrees of resolution. With those in hand, it is possible to focus on specific traits (or *memes*, *cf.* Shennan 2002) to make more informed hypotheses about the transmission of metallurgical knowledge, by searching for commonalities that might indicate direct, meaningful interaction more reliably than the mere presence of metal or a similarity in object forms. From this starting point, and considering other strands of contextual evidence, researchers can assess the extent to which new knowledge affected other social dynamics.

In this vein, Nessel and colleagues (this volume) approach the spread and significance of tin bronze based on a reassessment of the archaeological evidence and a comparison between Europe and the Near East. They evaluate two competing theories: one sees bronze as a materially superior metal that served the elites to support their position; the other one downplays the association of bronze and hierarchies, and suggests the relevant technology may have been transmitted as part of a kin-based system. According to these authors, the seemingly slow and spatially patchy adoption of bronze in Europe would appear to support the latter hypothesis, hence demystifying the somewhat presentist approaches that persist in some archaeometallurgical studies (see also Kienlin 2010; 2012). Without a doubt, the debate will continue.

At the other end of the interpretive spectrum, but addressing issues that are equally relevant, Perea (this volume) focuses on examples of goldwork from the Pre-Columbian Quimbaya and Late Bronze Age Iberia. No matter the different contexts and typologies, the detailed analytical study of these artefacts reveals in both cases a degree of 'technological excellence' that, in her view, was deliberately promoted by elites 'to obtain social and ideological revenues' (Perea, this volume). In the earlier context of the late 5th millennium BC in southeastern Romania, Lazar and colleagues (this volume) also relate the use of metals to the emergence of elites and the consolidation of a dominant ideology, while attempting to bring together the evidence for both the transfer of metallurgical technology, and the exchange of copper and gold.

It is worth highlighting here the benefit that studies of production remains may bring to research on knowledge transmission. The analysis of fixed structures such as smelting sites, crucibles and slag might at first seem alien to the world of prehistoric mobility, and it is therefore unsurprising that such studies are absent from this book. However, comparative analyses of production residues can provide additional information on the choices or technical styles of those who made metal, and hence their possible

learning traditions. As a case in point, one of the editors of the book has reinvigorated efforts to address the idiosyncrasy of Iberian copper metallurgy in the Chalcolithic, showing that not only artefact typologies and functions, but also the associated tools, infrastructures, technical sequences, contexts, intensity and social significance are notably different from those known for the rest of the Old World (Murillo-Barroso and Montero-Ruiz 2012; Murillo-Barroso *et al.* 2017). This evidence strongly suggests that metallurgy may have developed independently in Iberia or that, even if the inspiration came from elsewhere, the social and natural environment shaped a radically different evolution.

There are further good reasons why we should retain an interest in technological aspects when addressing the movement of metals and knowledge. One obvious justification is metal mixing and recycling, a technological practice whose actual incidence in the Bronze Age remains a subject of contention, but which undeniably blurs the signatures we typically use for metal provenance. While this has long been known as a methodological hurdle (*e.g.* Tylecote 1970), Bray (this volume; see also Bray *et al.* 2015) has managed to turn this challenge into a research area in its own right, seeking as he does to trace the flow of metals on large temporal and spatial scales. Similar considerations of how technological processes affect provenance tracers are also recognised for iron (Charlton 2015) and other materials such as glass (Rehren and Freestone 2015), progressively diluting the neat separation apparent in traditional studies of 'technology and provenance'.

Another relevant example of the pertinence of considering technology and provenance hand in hand is the re-emerging topic of tin isotopes. Nessel and colleagues (this volume) recognise that in spite of great advances achieved in instrumental sensitivity and precision, there are two seemingly unsurmountable problems: one is the substantial overlap between some sources (notably, Cornwall and the Erzgebirge), which invalidates the provenance postulate and constrains the applicability of the method; the other one is the mass-dependent isotopic fractionation that is known to take place if tin is smelted in insufficiently reducing atmospheres (Berger *et al.* 2017; 2018), leading to mismatches between metal and source. Here is where the technological dimension kicks in again: while we might be tempted to assume that Bronze Age metallurgists used the most efficient technologies available to them, and hence smelted tin in suitably reducing furnace environments, we now have evidence for the prehistoric production of bronze by cassiterite cementation in relatively open crucibles in Iberia (*e.g.* Rovira 2007; Figueiredo *et al.* 2010; Rovira and Renzi 2016; Farci *et al.* 2017), Britain (Northover 1987), the Caucasus (Erb-Satullo *et al.* 2015), Egypt (Rademakers *et al.* 2018) and Thailand (Murillo-Barroso *et al.* 2010). All of the bronzes produced by this method may have tin isotopic signatures that are different from

those in the parent ores. Clearly, we need more experimental simulations to determine if we can predict the extent of isotopic fractionation depending on the alloying and casting conditions. The results of these experiments may dishearten those who expected tin isotopy to bring about a revolution in metals provenancing, but with the silver lining that we might be able to unlock details of the technological history of the objects through isotopic analyses. Considering that cassiterite cementation co-existed with other bronze-making methods, sometimes in the same workshops (e.g. Rademakers *et al.* 2017), it may be worth exploring for correlations between artefact types and bronze-making technologies in particular contexts, based on data from tin isotopes. Taking advantage of recent refinement on the study of copper isotopes (Powell *et al.* 2017; 2018; Jansen 2018), I also see great potential in combined studies incorporating analyses of copper, tin and lead isotopes on the same bronze objects, comparable to the multi-isotope studies more routinely conducted on biological materials.

The only chapter in this volume focused on productive contexts is that by Rafel and colleagues (this volume), which offers a highly informative diachronic perspective on the exploitation of a single mining region in northeast Iberia. Their study clearly demonstrates temporal changes in the intensity of mining, the degree of specialisation of miners, and the circulation, use and value of lead and copper. As the authors point out, it is essential that studies of this kind are integrated with those addressing metal provenance and trade, not least as a way of ground-truthing broader theories about the social impact of metallurgy that tend to be biased towards the analysis of finished objects.

Metals

Researchers should not forget the ultimate reason why metals were mined, smelted and traded in the first instance: the users. I mentioned above the debates, exemplified in some chapters of this book, about the social significance of metals as status markers in different contexts. A key parameter here is the extent to which we can be certain that users would know (or indeed care about) the source of the raw materials, as acknowledged by both Bray (this volume) and Melheim and colleagues (this volume). However, we should also consider the specific typologies, functions and use contexts of metals artefacts, and the extent to which material and immaterial properties of the metals would have affected their perception, valuation and demand.

In addressing ‘why silver is sexy’, Sherratt (this volume) devotes several pages to this matter, articulately explaining the confluence of factors that drove the use of silver in 4th Millennium BC Mesopotamia. Her suggestions about possible silver sources in Anatolia, the Iranian Plateau and the Caucasus provide an excellent case study to apply recently renewed analytical strategies to provenance silver

(Desautly *et al.* 2011; Wood *et al.* 2017), but I would like to highlight here her consideration of the culturally-mediated perceptive dimensions of silver. In addition to other contextual factors ranging from its relative abundance to the existence of a wine-drinking culture, Sherratt emphasises the peculiar colour and glow of silver, and its ‘uselessness’ for practical applications when compared to copper, which no doubt affected the use and value of the noble metal. These considerations echo the early ideas of Cyril Stanley Smith (1981), more recently developed in studies of the so-called ‘materiality’ of material culture (e.g. Jones 2004). It is clear that sensorial dimensions of metals would have affected the way in which humans engaged with them, in complex ways that defy binary categorisation as either functional or stylistic, conscious or unconscious. One such critical dimension is colour, and this is one material property that lends itself to quantitative measurement and comparison. Recent colorimetric analyses of copper alloys (Mödlinger *et al.* 2017; Radivojević *et al.* 2017; see also Kuijpers 2017) are paving the way for more rigorous studies in this direction, and thus catching up with studies of archaeological gold-silver-copper alloys, where colours are much more routinely considered and compared.

Also worth noting is the thoroughness with which Legarra (this volume) taps into the informative potential of the contexts of recovery of gold objects. He focuses on Early to Middle Bronze Age Crete and charts the typologies, chronologies and contextual associations of gold objects deposited in tombs, as a starting point to draw inferences about the social role of the precious metal. Dispelling typically generalising assumptions about the use of gold as a marker of individual status, Legarra notes that gold objects are only rarely found in clear connection with an individual, and they instead tend to appear mixed in collective burials; here, according to him, the deposition of gold may have been a form of collective conspicuous consumption that benefitted the broader community.

Legarra’s work issues a call for caution to those of us who sample archaeological metals for analysis, sometimes disregarding important information such as the typology and depositional context of the artefacts we study. Ironically, this is more frequently the case in large scale projects, where the complexity of the resulting datasets may outweigh the time, skill or will required to process and analyse this metadata, perhaps in the expectation that broad patterns based on large datasets may reveal everything we need to know. Most often, the vagaries of accessibility, artefact preservation, curatorial zealotry and bureaucracy affect what we can or cannot sample, and these external constraints inevitably mean that we have to be opportunistic in our approach to sampling. While this may occasionally facilitate serendipitous discoveries, we should not fail to explore the significance of contextual information for the artefacts we sample, and for those we do not. As such, we should

demonstrate much more rigour in explicitly addressing our sampling biases and how those may affect the power of our studies. As another relevant case in point, Rehren and Pusch (2012) have proposed a model for Late Bronze Age metal economy with three different spheres of circulation and deposition of copper, operating concurrently but manifest in markedly different types of contexts and object typologies, and potentially deriving from distinct sources. If we sample only one type (*e.g.* ingot hoards), we will obtain an extremely skewed perspective of the economic system and, potentially, a highly polarised picture of the significance of long-distance trade. As noted by Bray (this volume) for Early Bronze Age Britain, even in very large datasets one can identify clumps and gaps that will slant our interpretations unless we deal with them critically.

The end of archaeological science?

I started this chapter by citing a few studies that reflected on the status of archaeological science as the intersecting field where archaeologists and scientists interact, noting the achievements and conflicts emerging thereof. Understanding the production, use, deposition and value of metal objects inevitably requires the engagement of numerous other disciplines, from mineralogy through chemistry to physics and statistics. The role of these disciplines ranges from clearly ancillary contributions to dominant positions in defining questions, problems, methods and broader research frameworks, but the collective input of ‘the sciences’ in the archaeology of metals is undeniable and shows no signs of waning. As such, archaeometallurgy is traditionally classified under the umbrella of archaeological science, and hence it constitutes an appropriate arena to bring to this discussion.

Paradoxically, if we take archaeometallurgy as a proxy, and *Metals, minds and mobility* as a case in point, it would seem that archaeological science is on the verge of extinction. The bulk of the chapters in this book involve science and share metals as a common denominator, while they vary in their chronological and geographic scope, the methods employed and the way in which theories are engaged to pose and answer questions. In these pages we find metal objects just as we find miners, smelters and merchants, but also many other kinds of prehistoric individuals across the social spectrum, using a great variety of media to interact with their environment, and with each other. There are methodological refinements, economic theory, comparative archaeology and anthropology, reconsiderations of old data and theories, some bold and debatable claims, agendas for the future, and healthy academic disagreement. Attempting to single out ‘sciency’ papers from those that are more archaeological or theoretical would be, in my view, futile and imperfect, with the corollary that the starting premise of a dichotomy ‘archaeology vs science’ is not applicable

to a review here. Thanks to papers such as those included in this volume, archaeometallurgy is no longer a field where we need to worry about the integration of science and archaeology (but see *e.g.* Pearce 2016 for a dissenting view). Considering the archaeological science of metals as separate from a presumed mainstream archaeology would be anachronistic (and see Killick and Fenn 2012 for interesting overlaps with anthropology). Gone are the days of the Two Cultures, and I doubt that speaking about Three Cultures (*e.g.* Smith 2017; Sørensen 2017) brings much additional clarity. Archaeometallurgy is as rich and diverse as archaeology at large, and science is an intrinsic part of it. So long as complementary research areas not deprived of recognition, funding and significance, this is good news.

The end of archaeometallurgy as a branch of archaeological science might sound like radical omen, but it may seem less so if we look at it from a historical perspective. For example, while they were seen as revolutionary scientific contributions in their heyday, very few would now talk about stratigraphy or the use of GPS as archaeological science: they are just part of the intellectual and methodological toolbox that archaeologists benefit from. I will not attempt to provide a comprehensive list of the scientific contributions that are now part of ‘ordinary’ archaeology. I would simply invite readers from wealthy nations to think about how they survey, excavate, record and study archaeological finds and features; how they analyse the information; how everything is conserved, stored, displayed and shared; and then, try to demarcate which areas would qualify as ‘archaeological science’. Without a doubt, we would disagree on where to place the boundaries, and we would probably change our mind if we were asked the same question again in a few years. Why is this the case, and should we do something about it?

Methods emerge and evolve, as do theories and research priorities, often in tandem. In many cases, the Gartner Hype Curve (Linden and Fenn 2013) (Figure 12.1/Colour Figure 12.1) provides an elegant model to chart the introduction and development of any innovation (including prehistoric innovations, but this is a subject for another study). In the history of archaeology, the narrative would broadly be as follows: the new scientific technology enters the scene with a peak of high visibility and inflated expectations – a ‘revolution’, typically accompanied by papers in top-tier scientific journals; this is followed by a trough of disillusionment, triggered by rebuttals that rarely make it to those journals, but which nonetheless make valid points about imperfections in both the applications of the new technology and the interpretations derived (albeit with the regrettable outcome that a few sceptical individuals will cling to these arguments and never look back); in due course, those imperfections are addressed in a slope of enlightenment, and the technology reaches maturity in a so-called plateau of productivity. At this point, well-informed archaeologists will

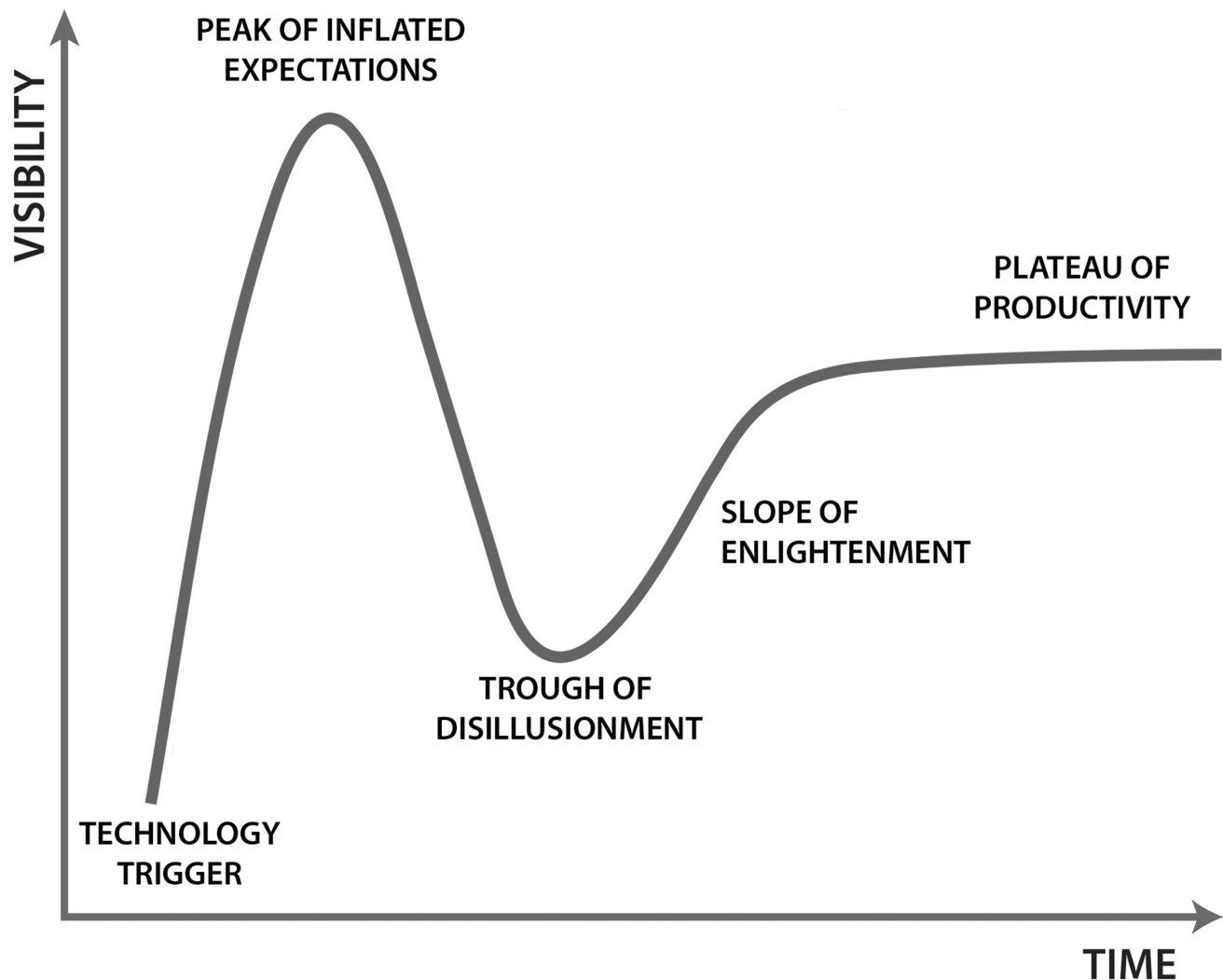


Figure 12.1 The Gartner Hype Curve for emerging technologies

accept the potential of the new technology, and incorporate it in their own work if relevant – the approach is no longer ‘archaeological science’. A quick look at the history of archaeological science will provide numerous examples, with radiocarbon dating and lead isotope analyses being two illustrative instances of technologies currently in their plateau of productivity, having overcome their respective backlashes; whereas the study of other isotope systems, notably those employed in the study of biogenic materials, are still climbing the slope of enlightenment; 3D modelling and other forms of digital image capture and analysis are still enjoying their peak – though probably not for much longer; finally, next-generation aDNA studies are enduring the trough, but there is no doubt that they still have much to contribute to archaeology as a whole, once they reach their plateau of productivity.

Whatever we choose to call it, it is obvious that the shape of archaeological science will keep shifting, as

more scientific developments will be adopted and adapted after their initial hype as the latest science newcomers to archaeology. We should of course retain our critical attitude, not towards science *per se*, but towards the whole field of archaeology, and any innovations in particular – be them in methods or in theories alike. We will identify poor papers across the board – bad science, bad archaeology, half-baked theory, unjustified waste of resources, and/or unethical intrusions into the integrity of archaeological heritage – but if these studies are no longer representative of our field, I would suggest that we leave them behind and save our energy to learn from the examples of good practice.

From the foregoing it should be sufficiently clear that, when we focus on the best rather than picking on the worst, I no longer recognise a neat divide between archaeology and archaeological science (Martín-Torres and Killick 2015). Even drawing a gradual spectrum from the more theoretical to the more scientific has become increasingly difficult – which

is, in my view, excellent news. I suggest that if we wish to take positive action to remedy a latent divide in contemporary archaeology, our target should not be a purported split between scientists and non-scientists, but between those who research ‘things’ and those who research ‘(once) living beings’ (for lack of better terms, and acknowledging the imperfections of these categories). If we take again *Metals, minds and mobility* as an example, we will find mobility of metals at the centre, but also relatively frequent cross-references to amber, lithics, ceramics or rock art, among other media that also inform about prehistoric mobility and minds. Conversely, and bar for a couple of exceptional references in passing, there is relatively little engagement with environmental and biomolecular archaeology, physical anthropology or osteoarchaeology – to name but a few of the self-recognised subdisciplines that deal with humans, animals, plants and landscapes. We therefore learn about mining and smelting, but not about the impact of metallurgy on the miners’ health and their environment. We see insightful analyses of countless axes and adzes, but no attempt at testing the actual effect of these in changes in agricultural or other subsistence strategies. We read discussion about the links between exotic metals and status, but we do not see if the special social status suggested by metals is reflected in other aspects such as ancestry, human mobility or diet. Here and elsewhere, we find superb examples of how technology, trade and material culture were used to construct identities, but only limited attempts at understanding the interplay between these and other defining features of ethnicity, from genes through climate to food. The same could be said, but in reverse, of the bulk of research published in bioarchaeology and related fields. If we achieve better integration between the bio and the non-bio, mobility will remain as a major driving theme but we may see a resurgence of studies of identities and ethnicities, and their spatio-temporal evolution, as fluid entities that cross-cut biology and culture. If we shift the focus, ever so slightly, from mobility to ethnicities and identities, we will be compelled to consider a fuller set of archaeological evidence and remain aware of the nuances of the context at various analytical scales, while at the same time opening up new and fertile arenas.

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individually and in various permutations. I am sure I gained much more than I could offer them.

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